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**An Application of Behavioural Economics**

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# **Environmental Morale: An Application of Behavioural Economics**

Lory Barile

A thesis submitted for the degree of Doctor of Philosophy  
University of Bath  
Department of Economics

October 2013

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To Fabrizio

*My past, present and future*

## Abstract

This thesis makes a contribution to that part of the economics literature that explores how behavioural economics can inform environmental economics. Theoretically, the thesis develops the concept of environmental morale. Empirically, the study investigates the role of environmental morale on individuals' behaviour within two different contexts: recycling participation and intertemporal choices over different goods (i.e., money, environment, and health) and outcomes (i.e., gains and losses). Major objectives of this analysis are: to shed light on how environmental morale interplays with individuals' behaviour under different recycling policy schemes, and to examine whether temporal discounting is domain specific and depends on environmental morale heterogeneity. Original survey investigations are employed to analyse these issues.

Results highlight the relevance of environmental morale both in motivating individuals' contribution to recycling and intertemporal choices towards environmental outcomes. Regarding the interaction between environmental morale, recycling participation and government interventions, results from this analysis suggest that a facilitating *nudge* policy seems to be relatively more powerful in increasing individuals' contribution and motivation towards recycling. Considering intertemporal choices, a paradox of *hyperopia* seems to be located in data provided in this analysis.

Some of the original contributions of the thesis are, first the broader reconceptualization of the definition of environmental morale and its operationalization in analyses of questionnaire preferences. Secondly, in line with other areas of research (i.e., tax compliance literature); this study pursues an investigation of individual and cultural differences with respect to recycling policies, an area which has been neglected in the environmental economics literature. In this regard, the analysis considers a comparison between psychology and economics students in Italy and the UK. Thirdly, conditioning discounting on environmental morale offers a unique opportunity to analyse how ethical considerations influence the way individuals form expectations on (near and far distant) future environmental outcomes.

## **List of Abbreviations**

ANOVA	Analysis of Variance
BMU	German Ministry for the Environment
BMW	Biogradable Municipal Waste
CBA	Cost-Benefit Analysis
CET	Cognitive Evaluation Theory
CONAI	Italian National Packaging Consortium
CV	Contingent Valuation
DDR	Declining Discount Rate
DEFRA	Department for Environment, Food and Rural Affairs
DF	Discount Factor
DICE	Dynamic Integrated model of Climate and the Economy
DU	Discounted Utility
EAP	Environmental Action Programme
ECBA	Extended/Environmental Cost-Benefit Analysis
EEA	European Environment Agency
EKC	Environmental Kuznets Curve
EM	Environmental Morale
EPRI	Electric Power Research Institute
EU	European Union
E/WVS	European/World Value Survey
GDP	Gross Domestic Product
GHG	Greenhouse Gases
IIA	Independence of Irrelevant Alternatives
ILA	Infinite-Lived Agent
IPCC	Intergovernmental Panel on Climate Change
ISPRA	Italian Institute for Environmental Protection and Research
ISTAT	Italian Institute for National Statistics
K-F	Krutilla-Fisher
LATS	Landfill Allowance Trading Scheme
LSDV	Least squares dummy variable

MFA	Multi-way Frequency Analysis
MNPV	Multigenerational Net Present Value
NACE	European Classification of Productive Economic Activities
NID	Normally and Identically Distributed
NIMBY	Not In My Back Yard
NPV	Net Present Value
OECD	Organization for Economic Cooperation and Development
OIT	Organismic Integration Theory
OLG	Overlapping Generations
OLS	Ordinary least squares
RICE	Regional Integrated model of Climate and the Economy
RBWM	Royal Borough of Windsor and Maidenhead
RFF	Resources For the Future
SD	Standard Deviation
SDR	Social Discount Rate
SDT	Self-Determination Theory
SOC	Social Opportunity Cost
SPC	Shadow Price of Capital
S RTP	Social Rate of Time Preferences
UK	United Kingdom
WA	Weighted Average
WTA	Willingness to Accept
WTP	Willingness to Pay



## **List of key terms (selected items)**

This list contains selected key terms used in this thesis. The list also includes a description of common terms used in the behavioural literature.

*Autonomy*: individuals' need to be autonomous, though according to SDT this does not mean that people are independent of others' behaviour.

*Competence*: people's basic need to show their ability to control the outcome of specific tasks.

*Environmental morale*: the willingness or moral obligation to behave in an environmentally conscious way, whereby the inherent satisfaction to contribute to (and/or the moral obligation towards) the environment comes from ethical considerations.

*External regulation*: the least autonomous form of extrinsic motivation that occurs when individuals undertake an action contingent to external outcomes (i.e., external rewards or punishment).

*Extrinsic (or external) motivation*: a motivation that comes from external sources (i.e., drive-based behaviour).

*Homo economicus*: an economic agent who makes rational (or consistent) choices.

*Homo realitus*: an economic agent who is capable to make rational choices, but is also 'predictably irrational'.

*Integrated regulation*: the most autonomous form of extrinsic motivation taking place when regulations are fully assimilated within the individuals' self so that they become part of a person's self-evaluation and beliefs. Integrated regulation (or internalised norm) differs from intrinsic motivation as the latter

does not come from a cognitive process – i.e., an external regulation that becomes an autonomous regulation.

*Intrinsic motivation*: the natural and inherent enjoyment and interest to undertake novel and challenging activities.

*Introjected regulation*: the act of undertaking regulations although they are not fully accepted by individuals as their own. Differently from external regulation, this form of regulation is not contingent to external outcomes.

*Other-regarding preferences*: preferences over another individual's well-being, in addition to one's own.

*Paradox*: a term used to describe departures from rational behaviour.

*Paradox of hyperopia*: a specific kind of paradox used in this work to illustrate a certain departure from rational behaviour. According to the literature, in fact, ethical considerations should generate less myopic behaviours towards future generations, which translates into disapproval of discounting. However, results obtained in this study move in an opposite direction and suggest that people with a long-sighted view are also more impatient. As such, they discount environmental gains more than losses, but, compared to less environmentally-friendly individuals, they are less willing to postpone losses to (near and far distant) future generations.

*Present bias (or impatience)*: an 'irrational' disutility of waiting, which translates into the desire of receiving gains and postponing losses immediately.

*(Pure) Altruism*: individuals' disposition to care about others' well-being.

*Reciprocity*: the tendency to respond in kind to kindness and to retaliate harmful acts with no material gains expected by the actors.

*Regulation through identification:* a more autonomous form of extrinsic motivation that occurs when people recognise the importance of a regulation and value such regulation as personally important.

*Relatedness:* individuals' willingness to interact and be connected with others.

*Relative price effect:* the effect of monetary incentives on individuals' behaviour. Generally, according to mainstream economics the relative price effect has a positive effect on the provision of (rational) individuals' activities.

*Social norms:* socially shared beliefs about how one ought to behave.

*Titration procedure:* is an elicitation procedure used to infer which of the alternative respondents prefer among a set of multiple choices.

# Chapter 1

## INTRODUCTION

### 1.1 INTRODUCTION AND RATIONALE OF STUDY

This thesis makes a contribution to that part of the literature that explores how behavioural economics can advance the science of environmental economics. Environmental economics has traditionally been focused on developing solutions to market failures. Market failures are typically associated with externalities, public goods, and asymmetric information. Economists refer to these sources of economic inefficiency to design and evaluate public policies for environmental sustainability, which include command and control regulation (i.e., emission standards) as well as price-based instruments (i.e., Pigovian taxes, tradable permits, fines and subsidies). The idea that economic theory can prevent market failures is based on the assumption of *rational* behaviour – i.e., consistent behaviour. Rational choice theory is a key concept for neoclassical welfare economics, which suggests the adoption of a prescriptive approach to guide environmental policy. Indeed, if people make consistent and systematic choices, predictions can be made when *homo economicus*<sup>1</sup> faces new constraints.

Despite the attractiveness of this approach, over the past four decades, numerous empirical studies in different areas of research have pointed out the limits of human behaviour providing evidence for systematic deviations from rational choice theory (see e.g. Tversky and Kahneman, 2000). Behavioural economics commonly analyses, describes and catalogues such deviations in three general categories: bounded rationality, bounded self-interest, and bounded willpower (see Shogren and Taylor, 2008). Bounded rationality (also known in the literature as ‘individual failure’ – see Cullis and Jones, 2009) refers to the idea that even under perfect information individuals might not be able to make rational choices. Rather, they may use rules of thumb and shortcuts to make decisions, which produce behavioural

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<sup>1</sup> This term is also referred in the literature as Rational Economic Man (REM).

biases. Bounded self-interest is related to individuals' concern for others' well-being. Many studies in the literature provide, in fact, evidence for emotive or 'other-regarding' preferences (i.e., reciprocity, altruism, and inequity aversion). Bounded willpower relates to lack of self-control. Examples are procrastination, instinctive decisions and saving too little.

Departures from rational behaviour lead to behavioural 'failures', where behavioural failure here indicates a person who fails to behave as predicted by rational choice theory. The literature accounts for a significant body of evidence of behavioural failures, commonly referred to as an anomaly, paradox, heuristic bias, and fallacy. This suggests that, in some circumstances, rational choice theory might be a poor guide for economics in general, and for environmental economics in particular (see Shogren and Taylor, 2008). According to Crocker et al. (1998, p. 159), "because the most visible and well-understood exchange institution, the competitive market, has relatively little role in arbitraging environmental assets...a public policy focus for environmental assets upon the findings of benefit-cost analysis narrowly interpreted in terms of the real individual's hypothetical, impeccable utility maximization is highly problematic and plausibly self-defeating". Specifically, the absence of an active market arbitrage to encourage consistent choices among individuals can generate anomalous behaviours; undermining rational expectations underpinning environmental policy (see Shogren and Taylor, 2008).

This has recently motivated some scholars to argue that government interventions can be justified to correct both market and behavioural failures. Such a new form of intervention envisages a more paternalistic role of the government not only to guarantee environmental sustainability but also to deal with what is known in the literature as *homo realitus*<sup>2</sup>. Indeed, if in the presence of market failures (such as with public goods) there is an undeniable need for government intervention, when these failures are exacerbated by the arrival of *homo realitus*, in some circumstances, the size of the public sector might be even greater. Some researchers call this *libertarian paternalism* (see Thaler and Sunstein, 2008), where governments are legitimated to influence individuals' behaviour (albeit people are free to choose) to

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<sup>2</sup> An individual that is "reliant on bounded rationality, concerned with more than pure self-interest, and responsive to signals that affect preferences" (see Cullis and Jones, 2009, p. 487).

protect citizens from their own self-destructive anomalous behaviour and lack of self-control. If this new form of paternalism has credit, environmental policy makers should consider the taxonomy of possible behavioural failures undermining efficiency-promoting environmental regulations, thus taking into consideration their interaction with market failures to promote effective policy designs.

## 1.2 BACKGROUND LITERATURE

As compared to other areas of research, the literature lacks empirical investigations of relevant environmental behavioural failures. To the extent that this might be crucial not only to identify relative solutions to environmental problems, but also to partially explain why in modern economies people seems to be hesitant to adopt more sustainable behaviour, this is a quite surprising fact. More than a decade ago, Knetsch (1997, p. 209) suggested in fact that “in view of the evidence, the seemingly quite deliberate avoidance of any accounting of these [behavioural] findings in the design of environmental policy or in debates over environmental values, does not appear to be the most productive means to improvement”. The present research seeks to contribute towards answering two open questions in the environmental economics literature. First, how can behavioural failures inform environmental policy? Second, when are behavioural failures relevant to the science of environmental policy?

As suggested by Shogren and Taylor (2008), behavioural economics has had the biggest impact on environmental economics through the study of nonmarket valuation of environmental goods. Indeed, a well-documented behavioural anomaly in the literature is the discrepancy between the willingness to pay (WTP) and willingness to accept (WTA) monetary compensation for a commodity<sup>3</sup>, with the former being generally greater than the latter. Although the willingness to pay/accept asymmetry can be partially attributable (see e.g. Shogren et al., 1994) to lack of substitutability between tangible (e.g., money) and intangible (e.g., environment) goods, there is a general consensus over the hypothesis that the *endowment effect* – i.e., the tendency to value goods that are owned by individuals more than those not

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<sup>3</sup> With small income effects and many substitutes, the willingness to pay e.g. for a public good change and the willingness to accept compensation to postpone the same change should coincide. However, empirical evidence suggests that this is wrong (see e.g. Kahneman et al., 1990).

held in their endowment – plays a major role here. Without wishing to carry this discussion any further in this work, it is interesting to note that over the past decades, the incorporation of the endowment effect into welfare theoretical models and the role of government intervention in the presence of this behavioural anomaly have triggered many responses among scholars, albeit leaving unresolved questions.

Besides the willingness to pay/accept asymmetry, there might be many other situations where behavioural failures may affect the way researchers and policy makers think about environmental policy designs. Shogren and Taylor (2008) identify choices under risk, environmental conflicts and cooperation, and the use of mechanism design to control for market failure as possible sources of behavioural failure. However, scarce empirical evidence (if any) exists in the literature documenting the presence and implications of behavioural anomalies within these contexts.

### **1.3 OBJECTIVES OF THE STUDY**

This study aims to analyse the impact of environmental morale on individuals' behaviour. In recent years, scholars have widely recognized the importance of morale considerations (or social norms) on individuals' behaviour (see Halla and Schneider, 2013). The failure of the neo-classical model of tax evasion to predict real-world compliance for example has lent credence to the hypotheses that benefit and tax morale – i.e., 'the morale motivation to abstain from cheating on the state *via* benefit and tax evasion, respectively (see Halla and Schneider, 2013, p. 3) – play a major role in determining compliance behaviour. Despite an increasing number of papers acknowledging the role of environmental morale as a driving force for pro-environmental behaviours (see e.g., Frey, 1997, and Frey and Stutzer, 2006), to date empirical evidence on the casual link between environmental morale and pro-environmental behaviour is largely missing (Torgler et al., 2009, and Feldman and Perez, *forthcoming*, are exemptions). A possible explanation for the relative neglect of empirical analyses of these issues can be related to problems in disentangling behaviour arising from intrinsic (i.e., inherent to the individuals' self) and extrinsic (i.e., outside the individuals' self) motivation using secondary (rather than primary)

data. This can be even more problematic when terminology in the literature is confusing and there is overlap between the definitions of different concepts. This confusion is particularly apparent in the case of environmental morale.

Environmental morale is generally referred to as the result of the aggregation of internalized norms and intrinsic motivation (Frey, 1997, Frey and Stutzer, 2006). Internalized norms can be considered as moral obligations that come from a cognitive process – i.e., an external regulation that becomes an autonomous regulation (see also Coleman, 1994). Intrinsic motivation represents instead “the doing of an activity for its inherent satisfaction rather than for some separable outcomes” (Ryan and Deci, 2000a, p.56) – i.e. extrinsic motivation. However, the distinction between the two terms becomes subtle, especially when norms have been internalized (see Frey and Stutzer, 2006). If a non-intrinsically motivated behaviour (i.e. obeying a social norm) becomes an internalized value, individuals feel a sense of obligation to that norm, and acting against this moral responsibility results in negative feelings (i.e. feelings of guilt and frustration, reduced self-esteem, and other negative self-evaluation).

In order to address these aspects, the present study employs original survey questionnaire analyses and proposes a broader and novel definition of environmental morale which comprises attitudes and beliefs towards the environment driven by ethical considerations (e.g., it is wrong not to behave according to eco-conscious considerations). As an analogy with the tax evasion literature (Torgler, 2005, p. 526), environmental morale will be defined as the intrinsic motivation (or behavioural motive) to contribute to a better environment. That is, environmental morale represents individuals’ willingness or moral obligation to behave in an environmentally conscious way, or their belief in contributing to society by displaying pro-environmental behaviours. Likewise, tax morale includes feelings of moral regret or guilt over cheating on taxes, so environmental morale might involve individuals’ oppressiveness (i.e. negative feelings) as a deterrent to free riding. The



greater such oppressiveness, the more individuals will be driven towards more sustainable behaviours<sup>4</sup>.

A common practice in the literature on tax compliance and benefit fraud is to employ large micro data sets from the European and World Value Survey (E/WVS) to investigate the role of morale on individuals' behaviour. Morale is generally inferred from specific questions of the E/WVS justifiability section. The E/WVS single-items used to assess respectively the level of tax and benefit morale are framed as follows: 'Please tell me for each of the following statements, whether you think it is never justified, always justified or somewhere in between: ...cheating on taxes if you have the chance...claiming state benefits which you are not entitled', where a ten-point Likert scale (1 = never justified, 10 = always justified) serves to assess different levels of morale. A similar approach has been recently used by Torgler et al. (2009) to analyse the relationship between environmental morale and pro-environmental behaviour. Within the justifiability section of the WVS, the authors assess the level of environmental morale according to answers provided to the option 'throwing away litter in a public place'. However, there are some limitations to this approach. Given the peculiarity of the questions related to tax and benefit fraud, a single-item approach seems to be feasible to capture tax and benefit morale. Considering environmental morale, the available question in the WVS tends to capture only a single aspect of environmentally-friendly behaviours. Therefore, a multi-item index might be more appropriate to provide a comprehensive measure of individuals' morale (see also Torgler et al., *ibid*)<sup>5</sup>. For this reason, in the current research environmental morale will be inferred using different sets of questions (index-items) regarding environmentally-friendly attitudes towards the environment (i.e., willingness to buy a 'green' product rather than a conventional identical good, and individuals' attitudes towards energy and water saving, recycling and use of public transit). Compared to other approaches, survey analyses/experiments in general and primary data in particular have the advantage of controlling for specific

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<sup>4</sup> Despite these similarities, perhaps the most relevant difference between the two concepts lies on the consequences on wealth and resource redistribution. Indeed, while tax compliance is generally associated with income redistribution within a country, environmental morale is commonly related to the allocation, distribution and use of environmental resources. Thus, it can be argued that, differently from tax compliance, failing to contribute to a better environment now might have a major impact on future generations.

<sup>5</sup> Pros and cons of using a multi-item index will be discussed in detail in the following chapters.

factors explaining individuals' behaviours, thus providing a unique opportunity to examine peculiar aspects of a particular phenomenon.

Based on this definition, the main contributions of this work are to examine whether or not environmental morale plays a major role in determining individuals' behaviour towards the environment, and to analyse how this can inform policy makers to design effective policy measures. The linkage between environmental morale and individuals' behaviour will be investigated in two different contexts: recycling participation and intertemporal choices. First, the analysis seeks to shed light on how different policy designs (i.e., voluntary scheme, facilitating nudge scheme, and mandatory scheme) interplay with individuals' willingness to participate in recycling activities *via* a crowding-out/in effect of environmental morale. In contrast with the orthodox literature, which suggests that the success of the economic approach to human behaviour is due to the *relative price effect*, many contributions in different fields of study show that price-based instruments (e.g. rewards, fines, and taxes) undermine moral motivation<sup>6</sup>. However, to date there seems to be only one study (see Feldman and Perez, *forthcoming*) that analyses the relationship between external incentives and individuals' underlying motivation<sup>7</sup>. Likewise other non-monetary motivations (e.g., altruism), environmental morale can be relevant for policy implications because it can render certain policies less effective (crowding-out) and others more effective (crowding-in). Thus, understanding the interaction between environmental morale and policy regulation is critical to successful policy implementation, as in one set of circumstances they can reinforce each other, whereas in another set of circumstances they can be offsetting.

Second, given the relevance that ethical considerations have received in the theoretical literature of discounting, the present analysis seeks to further explore whether temporal discounting is *domain* specific and depends on environmental morale heterogeneity. There are only a few studies in the literature that analyse the differences in discounting between environmental and other domains (e.g. Guyse et al., 2002, Böhm and Pfister, 2005, and Hardisty and Weber, 2009), and the available

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<sup>6</sup> For a review of the literature see e.g. Frey and Jegen (2001).

<sup>7</sup> However, as it will be further discussed in the following chapters, Feldman and Perez (*forthcoming*) consider different external incentives than those considered in this analysis.

studies provide controversial results. Some support the adoption of different discount rates for different commodities (see e.g. Böhm and Pfister, 2005, and Gattig and Hendrickx, 2007) – i.e., discounting is domain specific. These studies in general find a lower discount rate for environmental goods, which seems to be justified by the presumption of ethical concerns about future generations. Alternatively, other contributions to the literature suggest using a single discount rate for all goods (see e.g. Hardisty and Weber, 2009) as differences in discounting are context (or *valence*) and not domain dependent. This is an unexpected result, which however represents good news for researchers and politicians who generally attempt to set a unique official discount rate for judging long-term projects and investments (see Hardisty and Weber, *ibid*). Although these studies provide possible explanations for discount rate differences, to the best of the author's knowledge, there are no empirical analyses in the literature that attempt to explain the connection between environmental morale and discounting environmental outcomes. To the extent that people form expectations on future outcomes by means of two different neural systems (see Loewenstein and O' Donoghue, 2007) – i.e., deliberative (or cognitive) system *vs.* affective (or emotional) system – it is interesting to investigate how environmental morale interplays with the two systems and how this influences discounting. Understanding the factors that affect discounting is of crucial importance for analysis of decisions that imply a trade-off between current and future benefits and costs.

## **1.4 OUTLINE OF THE THESIS**

Given that environmental morale is a key concept in this thesis, chapter 2 provides a comprehensive description of the interaction between intrinsic motivation and extrinsic motivation based on a psychological and an economic perspective. Alongside the theory, a simple model of motivational crowding-out/in effect is also outlined to vividly describe how individuals' environmental morale interacts with monetary incentives. This is followed by a critical literature review of the definition of environmental morale, which provides some insights into the linkage between environmental morale and other-regarding theories (i.e., social norms, altruism, and reciprocity). The chapter concludes with an overview of the existing contributions

describing how efficiency-promoting environmental instruments may crowd-out/in intrinsic motivation.

Chapter 2 provides the foundation and rationale for the survey questionnaire described in chapter 3. One of the major objectives of this survey is to investigate whether monetary incentives can be counterproductive, thus undermining individuals' intrinsic motivation to contribute to a better environment. The 'low cost argument' suggests that feasible areas of intervention can be found only in the private sector.<sup>8</sup> Therefore, the study focuses on individuals' attitudes towards recycling activities. Furthermore, given that in other areas of research (e.g., individuals' cooperation and tax compliance) the nature of *homo economicus* has been investigated both at the individual level and at the cultural level, the present analysis pursues a similar evaluation within the context of recycling behaviour. At the individual level, the analysis provides a comparison between psychology and economics students. At the cultural level, the study offers a cross-country comparison between Italy and the UK. The survey considers three different policy designs: a voluntary scheme, a facilitating nudge policy and a mandatory scheme. The aim of the questionnaire is to analyse how individuals' provision of efforts towards recycling changes with the policy schemes. Therefore, respondents' attitudes towards the facilitating nudge policy and the mandatory scheme are conditioned on the voluntary scheme (i.e., the benchmark situation). Follow up questions, socio-demographic/economic and attitudinal questions will contribute to understanding respondents' choices in the empirical analysis. This is presented in chapter 4 along with a discussion of policy implications.

The increasing attention that ethical concerns have received in the literature on discounting, their implications for intergenerational equity and environmental sustainability are highlighted in chapter 5. The scarce empirical evidence on how individuals' form expectations over tradable (i.e., money) *versus* non tradable (i.e., environment and health) future outcomes, and the lack of contributions on the linkage between environmental morale and discounting, legitimate the survey investigation described in chapter 6. The survey involves a *titration* procedure and a

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<sup>8</sup> The 'low cost' argument predicts that the more environmental morale costs to individuals, the less they tend to apply ethics in real-life situations.

*match task* where participants tradeoff a specific amount of money, trees and lives between the present and the (near and far distant) future. In addition, the questionnaire includes general questions about respondents (i.e., gender, and year of degree programme) as well as the same set of questions used in the survey described in chapter 3 to infer their level of environmental morale. The single indifference points obtained using the titration procedure and the allocation of goods derived by the match task allow us to investigate how individuals discount different goods by linking this with their level of environmental morale. Finally, after having presented comprehensive empirical analysis on two different contexts where environmental morale can be a key variable to explain individuals' behaviour, each explored using a large sample of respondents, the study concludes in chapter 7 with further discussion of pertinent findings.

## 1.5 CONTRIBUTION TO LITERATURE

In part this thesis adds to the existing literature on intrinsic motivation in general and on environmental morale in particular by filling some of its gaps. The novel definition of environmental morale and its linkage with other-regarding theories may offer a better understanding of the notion of environmental intrinsic motivation and of the extent to which intrinsic motivation can be influenced by extrinsic motivation. Some of the unique aspects of this thesis are: (i) use of primary data; (ii) definition of environmental morale by means of a multi-items index; (iii) analysis of the linkage between government signals (*via* policy designs) and individuals' behaviour towards recycling activities based on their underlying intrinsic motivation, and within the same context; (iv) analysis of the nature of *homo economicus* at the individual (i.e., psychologists *versus* economists) and cultural (i.e., Italians *versus* British) level; (v) analysis of how individuals form expectations about tangible and intangible (near and far distant) future outcomes, conditioned on their level of environmental morale.

One of the major contributions of this study is that it provides empirical evidence over the causal link between environmental morale and pro-environmental behaviors. Results highlight the relevance of environmental morale both in motivating individuals' contribution to recycling and explaining differences in discounting of

(and intergenerational preferences for) monetary, environmental and health outcomes. In general, results suggest that people exhibit different sensitiveness towards the environment depending on sex, degree choice and cultural differences. Within the context of recycling activities, the differences between the levels and the reasons for respondents' reactions to policy signals suggest that recycling can be better fostered with facilitating nudge policy measures than with mandatory schemes. Concerning discounting, a paradox of hyperopia seems to be located in data provided by this analysis – i.e., people that have a long-sighted view discount more environmental gains and are less willing to postpone losses.

Further discussions on these and some other findings will be presented in the following chapters.

## Chapter 2

# ENVIRONMENTAL MORALE AND MOTIVATION

## 2.1 INTRODUCTION

The success of the economic approach to human behaviour has generally been linked to the *relative price effect*, (Fehr and Falk, 2002). This predicts that *homo economicus* increases their effort supply as monetary incentives are contingent on performance. Building upon neoclassical theory insights, economists have traditionally suggested market-based instruments for environmental policy (e.g. green taxes, subsidies, tradable emission permits, etc.) as their efficiency was assumed to be superior to other instruments such as command and control regulation. Not surprisingly, compared to the 1990s (see for example Frey, 1992), the number of countries using monetary incentives (e.g. taxes, subsidies, rewards and fines) to reduce and control pollution emissions has massively increased (OECD, 2011).

After years of hesitation and based on the contribution of the psychological literature<sup>9</sup>, nowadays economists acknowledge the relevance of personal motivations other than *homo economicus* as a way to model ‘real life’ situations and actual human behaviour. As noted by James (2006, p. 598) “Factors such as social norms, morals, perception of justice, various attitudes, and particular beliefs can influence the way people behave, even sometimes if their own behaviour is not in their own immediate self-interest”. As such, environmental morale is commonly referred to in the literature as a way of reaching ‘desirable’ goals in environmental contexts (e.g. Frey, 1997; Frey and Stutzer, 2006; Nyborg, 2008).

Environmental morale might be particularly relevant when regulation is difficult to implement. However, it is much less clear whether relying on environmental morale is desirable when regulations are feasible and practical. Indeed, a large number of studies in different areas of research (i.e., labour supply, constitutional

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<sup>9</sup> To give an example, the opposing view of economists (who support market-based instruments) and psychologists (who support environmental ethics) is described by Frey (1999) as a debate between *Rationalists* and *Moralists*.

design, tax evasion, public good provision and common pool resources)<sup>10</sup> show that monetary incentives may undermine – crowd-out – moral or intrinsic motivation and therefore they can be counterproductive<sup>11</sup>. More importantly, in certain circumstances this may reverse the most fundamental economic ‘principle’ that states that monetary incentives boost supply. This not only suggests that *homo economicus* is only a single explanation of how human beings act and what they value (see also Eriksson and Anderson, 2010), but implies also that understanding the relationship between extrinsic and intrinsic motivation is crucial for the effectiveness of economic instruments.

The present analysis seeks to make a contribution to this area of research and to shed light on how people react to different government signals (*via* policy designs) according to their level of environmental morale<sup>12</sup>. Any study is incomplete without a discussion of the relevant background literature supporting the empirical analysis. Section 2.2 briefly defines the concepts of intrinsic motivation and crowding-out/in effects from a psychological and an economic perspective. This gives insights into the importance of environmental morale and motivation. Section 2.3 provides a definition of environmental morale along with a discussion about the potential influence of ‘other-regarding’ theories on individuals’ intrinsic motivation to contribute to a better environment. It is followed by a review of the literature discussing the direction of the interaction between environmental morale and policy measures. Overall remarks are reported in section 2.5.

## 2.2 INTRINSIC AND EXTRINSIC MOTIVATION

Deci and Ryan (1985) define intrinsic motivation as an energy source that is of fundamental importance in the nature of organisms. Its recognition strengthens the

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<sup>10</sup> See, for example, Marwell and Ames (1979), Gneezy and Rustichini (2000a), Gneezy and Rustichini (2000b), Frey and Oberholzer-Gee (1997), and Frey and Meier (2004).

<sup>11</sup> Previous studies on the effect of monetary incentives to intrinsic motivation considered the consequences of introducing rewards to motivate individuals to desirable behaviours. Therefore, the effect is termed in the literature in many other ways, such as ‘The hidden cost of rewards’ (Lepper and Greene, 1978), ‘Overjustification Hypothesis’ (Lepper et al., 1973), or ‘Corruption Effect’ (Deci, 1975).

<sup>12</sup> To the best of the author’s knowledge there seems to be only one study that examines the relationship between economic incentives and individuals’ underlying motivation (see Feldman and Perez, *forthcoming*). However, differently from this study, Feldman and Perez (*ibid*) consider deposit, mandatory scheme and voluntary contribution as external incentives.



idea that all behaviours are not drive-based<sup>13</sup> and they are not merely a function of external controls. In contrast, there are actions that humans undertake only for the inherent gratification received internally from the activity itself (see Deci, 1971, Fischhoff, 1982, and Ryan and Deci, 2000a, 2000b).

The effects of circumstances that determine or regulate behaviour with respect to motivational processes are explained by Cognitive Evaluation Theory (CET). The theory, first introduced by Deci (1975)<sup>14</sup> has been changed in several ways since its initial formulation and now is considered a subtheory of the Self-Determination Theory (SDT)<sup>15</sup> that particularly analyses the relationship between self-determination and the perceived concept of competence. Specifically, as suggested by Ryan and Deci (2000a) all events (e.g. rewards, feedback, and communication) that produce feelings of competence enhance intrinsic motivation because “they allow satisfaction of the basic psychological need for competence” (ibid, p. 58). However, in order to be effective, feelings of competence need to be accompanied by a sense of autonomy, or alternatively, by a sense of *internal perceived locus of causality*. In other words, a high level of intrinsic motivation can be sustained if and only if people experience satisfaction of the needs of competence and autonomy<sup>16</sup>. It is important to underline that intrinsic motivation plays a role only when the activities “have the appeal of novelty, challenge or aesthetic value” for the individual (ibid, p. 60). According to Ryan and Deci (2000a), a common example is represented by the behaviour of little children. They pick up things, throw them away and ask questions about them because they are perhaps intrinsically motivated to learn or to undertake challenges. However, for all of these actions they do not receive any rewards, which are instead inherent in the activities themselves. The primary motivation is therefore the curiosity and the internal experience that guides the behaviour.

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<sup>13</sup> Drive-based behaviours are generally induced by external interventions.

<sup>14</sup> CET was initially introduced to illustrate the effect of external intervention on individuals’ motivation. Later it has been elaborated and refined by Deci and Ryan (1980) and Ryan (1982) who integrated a detailed description of how internal processes regulate social events.

<sup>15</sup> Self-determination theory investigates the psychological needs for understanding people’s self-motivation and personal integration, i.e. needs for competence, relatedness and autonomy (Ryan and Deci, 2000a, 2000b).

<sup>16</sup> The relevance of these feelings to maintain intrinsic motivation has been showed by many studies in the psychological literature. On the issue of competence see for example Deci (1971) and Deci and Cascio (1972). On the issue of autonomy see Zuckerman et al. (1978).

Intrinsic motivation is not the only behavioural motive that guides human beings. Indeed, it can be argued that most of the actions people undertake, especially when childhood is ended, depends on other forces, e.g. social pressure and other responsibilities in the society (see Ryan and Deci, 2000a), namely extrinsic motivations. Extrinsic motivation links individuals' performance to separable outcomes rather than those embodied in the action itself. Real life accounts for many circumstances where individuals are motivated by the expectation of separable outcomes (e.g., in most of the environmental contexts, in voting situations, and in general in all situations where subjects act instrumentally rather than enjoying the activity they undertook). To give an example, a person who stops driving under the influence of alcohol might be extrinsically motivated by his/her fear of receiving a fine for doing so.

According to the Organismic Integration Theory (OIT), the lowest form of autonomy among the different types of external motivation is represented by external regulation (e.g., extrinsic rewards or punishments). Here individuals experience an *external perceived locus of causality* driven by control and alienation. Within this context, certainly there exist more autonomous types of extrinsic motivation, namely: introjected regulation, identification and integrated regulation. In introjected regulation, subjects act under feelings of pressure (i.e., anxiety and guilty, or ego-enhancements and pride). In the process of identification, people identify the importance of the behaviour and accept its regulation as their own. Finally, integrated regulation occurs when an identified regulation is internalized, even if its behaviour is justified by instrumental values (i.e., separate outcomes). However, theorists usually consider external regulations the only type of extrinsic motivation that would crowd-out intrinsic motivation. Therefore, a central question in the literature is how to motivate people to value and regulate such non-interesting and externally motivated activities, in order to promote more autonomous regulation. This is defined by the SDT theory as the process of *internalization* and *integration*, and describes how an apathetic person can become a passive compliant person and finally can show active commitment to the behaviour. If a norm is internalized, individuals feel a sense of obligation to that norm, and acting against this moral responsibility results in negative feelings (i.e., feelings of guilt and frustration, reduced self-esteem, and other negative self-evaluations). Therefore, if a non-

intrinsically motivated behaviour (i.e., obeying a social norm) becomes an internalized value, the two motives become subtle. Indeed, individuals will not act according to their feelings of guilt or pride, but they will follow their intrinsic motivation of observing their own moral values.

A central role in this context is represented by the concepts of relatedness and competence. On the one hand, relatedness states that subjects adopt a particular behaviour given that other people to whom they are connected do so – i.e., friends, social groups, neighbours. This suggests that creating a sense of belongingness or connectedness to others can facilitate internalization. On the other hand, the more competence is acknowledged, the more individuals feel efficacious with respect to the adoption of an extrinsic goal as their own, thus promoting the process of internalization. As suggested by Ryan and Deci (2000a), competence and relatedness can only reduce to an introjected regulation by enhancing self-esteem and therefore self-determination. However, people may still feel to be controlled by the regulation. Nevertheless, in order to reinforce self-determination and self-regulation it is necessary to promote autonomy. It turns out that, in order to fully internalize a regulation, individuals must grasp its meaning and worth. This can only be guaranteed in environments that support competence, relatedness and autonomy.

For the purpose of this analysis, regardless the distinction between intrinsic and extrinsic motivation, what is relevant is the methodical relationship between the two.

### ***2.2.1 The interaction of intrinsic and extrinsic motivation: a psychological perspective***

Many scholars in psychology<sup>17</sup> have shown that external interventions (e.g. monetary rewards) under particular conditions undermine intrinsic motivation. According to the literature (see Deci and Ryan, 1985, Frey, 1997, Frey, 1999, Frey and Stutzer, 2006, and Nyborg, 2008) the hidden costs of monetary incentives affect intrinsic motivation according to three different processes:

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<sup>17</sup> For a good, although not quite updated overview, see Deci and Ryan (1985).

1) Impaired self – determination. In this case individuals substitute intrinsic motivation with extrinsic control and reduce their self-determination. This might happen because subjects no longer feel liable for their behaviour but attribute the responsibility of the task to the external institution (i.e., the controllers of their behaviour) that intervened from outside.

2) Impaired self- esteem. Here individuals perceive that their contribution is not acknowledged. Therefore external interventions decrease its value and subjects feel their involvement and competence are not appreciated.

3) Impaired expression – possibility. This effect is ascribable to Frey (1997) and occurs when a person is deprived of the possibility to show their intrinsic motivation to other persons.

In all cases, these processes contribute to the conclusion that with external interventions individuals feel they are abusing themselves if they maintain the same level of intrinsic motivation and therefore they reduce their performance. Changes in behaviour after an external intervention may be due to changes in preferences and/or task perceptions. Indeed, it can be argued that the former is more likely to occur when self-esteem decreases, the latter when self-determination is reduced. Furthermore, the above classification allows a delineation of the conditions under which the crowding-out effect emerges. On the one hand, crowding-out can occur if the external intervention is perceived as *controlling*. In this case, the external intervention reduces self-determination, self-esteem and the possibility for expression. However, when an external intervention is perceived as *supportive (or acknowledging)* an opposite effect is created – i.e., crowding-in effect. In this case self-esteem is fostered; individuals feel that they are receiving more freedom to act, thus increasing their self-determination. Some studies show, for example, that children of parents that are more autonomy supportive learn more spontaneously than those of parents who are more controlling (see Ryan and Deci, 2000a).

### ***2.2.2 The interaction between intrinsic and extrinsic motivation: an economic perspective***

According to Frey and Jegen (2001) one of the most relevant paradigms of economics is the relative price effect, which generally advocates that external interventions leads *homo economicus* to increase their provision of activity. Therefore, in the economic literature the crowding-out effect of intrinsic motivation generates one of the major behavioural anomalies<sup>18</sup>, since it predicts exactly the opposite reaction than that of the relative price effect.

This conclusion derives from the general model of principal - agent (see for example Petersen, 1993, Gibbons, 1998)<sup>19</sup> and it has been formally contextualized in this area of research by Frey (1997, 1999)<sup>20</sup>. The author suggests that when a principal introduces monetary incentives to motivate agents to undertake an activity, three different situations can be distinguished as follows:

1) Disciplining effect. External interventions raise agents' performance either when marginal shirking costs increase or, equivalently, marginal costs of performing decrease (e.g., using a fine). *Ceteris paribus*, if individuals are profit maximizers and the external intervention does not influence the marginal benefits of performance, the relative price effect predicts that the intervention raises performance. In this case, the crowding-out effect is neglected because intrinsic motivation is considered to be a constant or, alternatively, absent.

2) Crowding-in effect. If marginal benefits of performance are raised by external intervention, in addition to the disciplining effect, intrinsic motivation will also be raised since agent's motivation to perform increases. In this case, both the relative price and the crowding effects work in the same direction.

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<sup>18</sup> Economics accounts for many other relevant behavioural anomalies (see Thaler, 1992). However none of them (e.g. the endowment or the sunk cost effects) seems to reverse the predicted outcomes of the relative price effect (Frey and Jegen, 2001).

<sup>19</sup> The assumption here is that if workers are paid according to how they perform their performance unequivocally increase.

<sup>20</sup> See also Chang and Lai (1999), Bénabou and Tirole (2000), Frey and Jegen (2001), and Frey and Stutzer (2006) for the conflicting nature of the external intervention on individuals' behaviour.

3) Crowding-out effect. In contrast when external interventions undermine moral motivation (thus decreasing the marginal benefits of performance), agent's performance level is reduced. In this case the relative price and the crowding effects work in an opposite direction and the latter dominates the former. Whether intervening is beneficial from a principal's perspective depends on the relative size of these effects<sup>21</sup>.

Many authors (see for example Frey, 1997, Frey and Stutzer, 2006, Gawel, 2006) point out that external interventions may have also an additional indirect negative effect on intrinsic motivation, namely *motivational spillover effect*, in areas where the incentives do not exist. That is, people contribute only when external interventions are promoted. This phenomenon may happen for instance when performance increases only by means of the relative price effect and individuals do not internalize specific norms<sup>22</sup>, and it can have extremely negative consequences in areas where intrinsic motivation represents the only behavioural incentive.

To give an example, can the introduction of monetary incentives on recycling activities lead people to stop throwing away litter out of their moving car? If, on the one hand, it can be argued that monetary incentives in this context can induce improvements in individuals' performance<sup>23</sup>; on the other hand, the question is whether or not it would be possible to translate this positive behaviour into a crowding-in effect and to extend it to similar situations. Given the monetary incentives, people may be inclined to reduce their household waste due to the relative price effect. However, if intrinsic motivation is assumed to be constant (or absent) external interventions might not cause any additional increase in people's marginal utility of performance. As a matter of fact, this will be a deterrent for adopting the same behaviour in related contexts where incentives are not provided, leading individuals to feel free to continue to pollute.

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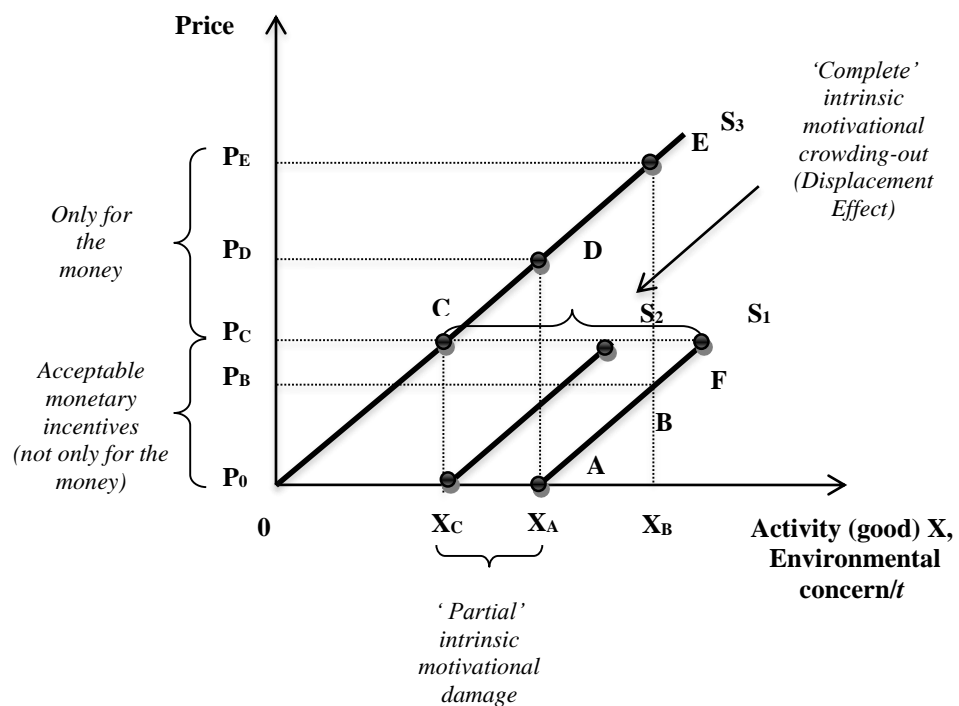
<sup>21</sup> Note that the crowding-out effect here depicted differs from the typical public good crowding-out effect as described in Andreoni (1989, 1990). Indeed, in this context, the reduction of individuals' performance is more likely to be attributed to undermined intrinsic motivation rather than instrumental considerations. These aspects will be discussed more in details in the following chapter.

<sup>22</sup> For a detailed analysis of the relationship between intrinsic motivation, norms and their internalization, see Coleman (1994).

<sup>23</sup> Some countries in the EU have used microchips to control people's attitudes towards recycling activities. For example, in the UK rewarding schemes have been applied with success in Windsor and Maidenhead Councils where residents increased their recycling by 35 per cent (RBWM, 2009).

Furthermore, one might speculate that, after introducing monetary incentives, if motivation is completely crowded-out it might be the case that, when removing the monetary incentive, individuals' motivation stabilizes at a lower level than it was when there were no incentives. That is, it is possible to have a *motivational displacement effect*<sup>24</sup>. This aspect can be easily shown by analysing the relationship between the relative price and the crowding-out effects graphically.

**Figure 2.1:** Motivational displacement effect: 'reversibility' *versus* 'path dependent' behaviour



*Notes:* Author's elaboration based on Frey (1997, p. 107).

Figure 2.1 illustrates how individuals' supply of an activity (good)  $X$  changes when crowding-out is allowed. According to Frey (1997), the supply curve  $S_1$  allows a positive supply of the good  $X$ ,  $0-X_A$ . This is a supply solely driven by intrinsic motivation – labelled in the diagram as 'environmental concern/ $t$ ' (i.e., environmental concern per unit of time  $t$ ). Here, in fact, price or reward is zero.

<sup>24</sup> This term is introduced in analogy with the Peacock and Wiseman's (1961) displacement effect hypothesis regarding government spending fluctuations. However, it differs from the same termed psychological concept introduced by Noddings (2003) which is referred to feminine' caring behaviour and their ability to understand the needs of the person for whom they are caring.

When prices are not perceived as controlling (i.e., in the interval  $P_0$ - $P_B$ ), the provision of a specific activity tend to increase (generating a movement up and to the right along  $S_1$ ). However, when the price reaches a certain level (i.e.,  $P_C$ ) the provision of the good decreases due to the crowding-out effect of intrinsic motivation (e.g., in the interval  $X_A$ - $X_C$ ). This shifts the supply curve  $S_1$  to the left (e.g.,  $S_2$ , where intrinsic motivation has been partially crowded-out) up to a point where intrinsic motivation is completely crowded-out (as supply decreases  $F$  to  $C$ ). At this point, performance will start to increase again only by means of the price effect (i.e.,  $S_3$ , with  $P_D$  leading to  $D$  and  $P_E$  to  $E$ ). That is to say that, individuals will consider monetary incentives acceptable up to point  $F$  (i.e., hypothetical threshold), where the provision of  $X$  will be mainly driven by individuals' intrinsic motivation – i.e., 'not just for the money'.

The question is: what happens if the monetary incentives are eliminated? For simplicity, the analysis will be focused only on two extreme situations. However, it is important to acknowledge that reality might be more complex and can include situations somewhere in between those illustrated below. Thus, going back to the previous question, depending on the strength of the crowding-out effect, in the extreme individuals can: (i) go back to the initial provision of efforts (moving downwards  $E$ ,  $D$ ,  $C$ ,  $F$ ,  $B$  to point  $A$ ), or (ii) gradually reduce their level of effort moving from point  $C$  to the origin. Hypothesis (i) is more likely to occur when behaviours are *reversible*. Hypothesis (ii) reflects the motivational displacement effect (i.e., moving  $X_A$  to zero at  $P_0$ ) and it is more likely to occur when history matters and behaviours are *path dependent*. The introduction of controlling market incentives has served therefore to irrevocably destroy intrinsic motivation. This suggests that governments may not be able to experiment with market solutions in other than a modest manner. In this context, in fact, assuming that from point  $C$  onwards individuals are mainly motivated by monetary incentives as in traditional neo-classical supply curves, the original supply of  $X_A$  is now only feasible if price or monetary reward is  $0$ - $P_D$  picking up point  $D$  on  $S_3$ . Therefore, when the external incentive is removed, individuals experience a decline in their ethical motivation up to the point where environmental concern is totally destroyed. Less than complete intrinsic motivation destruction (i.e., 'partial' intrinsic motivational damage) would pick up instead a point between  $0$  and  $X_A$  when  $P_0$  obtains  $X_C$ , leading to the supply



curve  $S_2$ . This could happen for example in all situations where people experience a change in their preferences rather than in the task's perception. It might be argued, in fact, that when individuals' preferences are altered it is more difficult to restore the pre-existing situation, especially if the behaviour for which intrinsic motivation has been crowded-out has a perfect substitute.

### **2.3 ENVIRONMENTAL MORALE: THE ROLE OF 'OTHER-REGARDING' THEORIES**

The preceding discussion offers insights into the relevance of environmental morale as the intrinsic motivation to contribute to a better environment. As mentioned in chapter 1, the literature appears to be confusing about the definition of environmental morale due to some overlap between different concepts (see Frey and Stutzer, 2006) – i.e., internalised norms and intrinsic motivation. In order to overcome this problem and in line with other areas of research (e.g., tax compliance) dealing with morale considerations (see e.g. Torgler, 2005), environmental morale will be defined here as the willingness or moral obligation to behave in an environmentally conscious way, whereby the inherent satisfaction to contribute to (and/or the moral obligation towards) the environment comes from ethical considerations<sup>25</sup>. The greater such satisfaction (and/or the moral obligation), the higher will be the willingness to prevent environmental degradation and 'abuses'.

Drawing on this definition, a further unresolved question in the literature is what influences such an intrinsic motivation. In particular, could extrinsic forces also play a role here? An increasing number of papers (see e.g., Frey and Stutzer, 2006, Nyborg, 2008, and Torgler et. al, 2009) have recently offered insights into the relevance of 'other-regarding' theories to help an understanding of how environmental morale might interplay with external regulation. These include social norms, altruism and reciprocal preferences. However, to date it is not clear to what extent environmental morale can be influenced by these different intrinsic and extrinsic motivations (Frey and Stutzer, 2006). This study provides therefore a first

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<sup>25</sup> Note that there might be 'strategic' interests in environmental morale. However, for the purpose of this analysis this possibility has been ruled out.

attempt to clarify and analyse these issues. Table 2.1 illustrates taxonomy of relevant concepts used below to explain the direction of such relationship.

According to what is stated in the previous section, crowding-out theory interferes with the *level* (i.e., the amount) of motivation by enhancing or reducing it according to the interaction between external interventions and internal motivation (Ryan and Deci, 2000a). This involves the specification of particular forces that undermine intrinsically motivated behaviour. From a psychological perspective, external interventions affect individuals' self-determination and self-esteem *via* a reduction of the perceived level of competence and autonomy in performing a task. An economic perspective would be different in that a reduction in motivation has to be found in the failure of the relative price effect, which leads the crowding-out effect to prevail.

An additional interesting aspect concerns the *orientation* of motivation, or alternatively the reasons why actions take place (Ryan and Deci, 2000a, 2000b). The economic perspective suggests that individuals as *homo economicus* tend to behave instrumentally to maximize their own utility. In other words, they behave with the expectation of obtaining other material outcomes from the action. The psychological perspective suggests distinguishing between intrinsically and extrinsically motivated behaviours (see e.g. Ryan and Deci, 2000a, 2000b). Intrinsically motivated behaviours associate individuals' satisfaction to feelings of competence and autonomy in performing the activity. Extrinsically motivated behaviours link individuals' behaviour to separable outcomes that come from outside the individuals themselves. To summarize, intrinsic motivation is something more inherent to the internal sphere of the individual, while extrinsic motivation regards external factors (e.g., material gains) that are able to influence individuals' motivation. The discussion here outlined lets us conclude that e.g. feelings of altruism, reciprocity and internalized norms fall into the category of intrinsically motivated behaviour, whereas social norms feed into extrinsically motivated behaviours. While social norms are not directly related to external material gains, it can be argued indeed that individuals' performance depends on extrinsic factors – i.e., social pressure (see also Ryan and Deci, 2000a). But, how can these considerations be linked to environmental morale?

**Table 2.1**

A taxonomy of specific ‘other-regarding’ preferences

Other regarding theory	Definition	Authors/Year
<i>Altruism</i>		
Pure Altruism	Individuals’ disposition to care about others’ well-being.	Barro (1974), Becker (1974), Andreoni (1988)
Impure Altruism	Individuals’ disposition to care about others’ well-being (pure altruistic component), and to experience the warm glow of giving (selfish component).	Andreoni (1989,1990)
<i>Reciprocity</i>		
Strong Reciprocity	Form of cooperation/retaliation with others similarly/dissimilarly disposed. Rewarding and punishing here can be personally costly and repeated interactions are not assumed.	Bowles and Gintis (1998, 2000)
Weak Reciprocity	Self-interested form of cooperation enforced by <i>tit-for-tat</i> behaviour. Here cooperation is linked to the desire of future material benefits.	Bowles and Gintis (1998, 2000)
Positive Reciprocity	Friendly-conditioned action where fairness emerges from fairness received.	Gouldner (1960), Fehr and Gächter (1998, 2000)
Negative Reciprocity	Unfriendly-conditioned action where unfairness emerges from unfairness received.	Gouldner (1960), Fehr and Gächter (1998, 2000)
Social Norms	Socially shared beliefs about how one ought to behave.	Cialdini et al. (1990), Frey and Stutzer (2006)
Internalized Norms	Cognitive norm – i.e., External regulation becomes an autonomous regulation.	Coleman (1994)

First, it can be argued that intrinsically motivated people with altruistic and reciprocal preferences might play an important role here (see Figure 2.2 below). Altruists will voluntarily contribute to the provision of environmental goods not only because of their ‘warm glow’ of giving (see Andreoni, 1989, 1990)<sup>26</sup>, but also for the sake of others’ well-being. According to Frey and Stutzer (2006), the limits of government interventions in specific situations (e.g. monitoring those who litter the streets with cigarettes or paper) reveal the importance of intrinsically motivated behaviours. It is particularly in these cases that environmental morale can be strengthened by altruistic preferences.

Secondly, reciprocal preferences can also be of crucial importance for the support and enforcement of social norms even in the presence of external regulations (Nyborg, 2008). This is particularly so in the case of *strong* reciprocity<sup>27</sup>. In contrast to *weak* reciprocity (also known as *tit-for-tat* behaviour), *strong* reciprocity implies either some form of cooperation with others similarly disposed or some form of retaliation towards those who disregard cooperative behaviour, even if both rewarding and punishing are personally costly and if individuals are not expecting to receive personal gains in the future (see e.g. Bowles and Gintis, 1998, 2000). The question is: how can an external regulation support intrinsic motivation under *strong* reciprocal preferences? Building upon experimental evidence (see e.g., Sudgen, 1984, and Fehr and Gächter, 2002), in its essentials, the argument runs as follows. Assuming individuals’ contribution is conditioned upon others’ contribution, a conditional co-operator feels a moral obligation to contribute only if others contribute too. By contrast, when others do not contribute, conditional co-operators feel no obligation to let themselves be exploited by free-riders (see Nyborg, 2008). As discussed further below, in this case, regulation (such as a fine or a tax) can control the otherwise undermining behaviour of free-riders (by forcing everyone to

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<sup>26</sup> The ‘warm glow’ of giving is a ‘selfish motive’ embodied in the definition of ‘impure altruism’ coined by Andreoni (1989, 1990). Impure altruism assumes individuals contribute to the public good not only because they take into consideration the others well-being, but also because they experience some additional benefits “from having done their own bit” (Andreoni, 1989, p. 1448).

<sup>27</sup> For these reasons, reciprocal behaviour differs deeply from ‘cooperation’ and ‘retaliation’ in repeated interaction since they are principally motivated by future material benefits. For a discussion see Kolm (2008) and Fehr and Schmidt (2006).

contribute at least a little); thus increasing the intrinsic motivation of conditional co-operators given that now they no longer feel exploited by free-riders. Along the same lines, *positive* reciprocity can also play a role when considering the interaction between external intervention and intrinsic motivation. In general, this form of reciprocity can be viewed as a friendly-conditioned action where fairness emerges as a response to fairness received<sup>28</sup>. This suggests that if people perceive regulation as fair and acknowledging they will respond in kind given their sense of gratitude towards the initial ‘giver’ (i.e., the government or the institution that has introduced the policy)<sup>29</sup>. *Vice versa*, they will fail to be compliant when the regulation is considered as unfair and controlling (i.e., *negative* reciprocity)<sup>30</sup>, thus reducing their intrinsic motivation. Based on these considerations, one can speculate that, compared to other monetary incentives (such as taxes and fines), the introduction or the expansion of kerbside collection will be more likely to induce individuals to be more (rather than less) involved in recycling activities given that such an intervention might reasonably enhance a sense of gratitude towards the government.

Finally, social norms or in Nyborg’s (2008, p. 2) words “the desire for a decent self-image” might also influence individuals’ behaviour and attitudes towards the environment (see e.g. Torgler et al., 2009). In general, social norms can be viewed as valuable beliefs about how one ought to act (see Cialdini et al. 1990, and Frey and Stutzer, 2006) according to what is socially acceptable/unacceptable or approved/disapproved (i.e., avoiding littering the streets, maintaining the quality of public parks), so that punishments for not complying come from the society itself (i.e., social pressure, namely the extrinsic motivation). Peer pressure may generate feelings of guilt or shame across members’ group. Therefore moral obligations towards the environment may apply even when people do not feel intrinsically motivated (i.e., they do not receive satisfaction) to observe the ‘norm’. This is what

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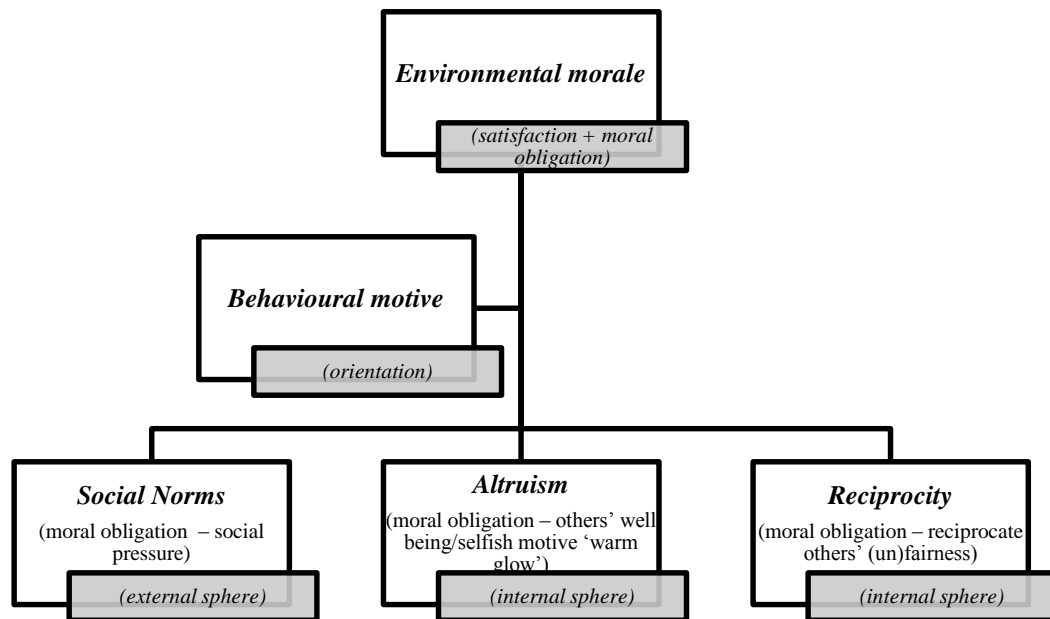
<sup>28</sup> This is what distinguishes positive reciprocity from unconditional kindness, which is motivated by altruism. Cox (2004, p. 262), e.g., describes *positive* reciprocity as “a motivation to repay generous or helpful actions of another by adopting actions that are generous or helpful to the other person”.

<sup>29</sup> The literature also accounts for other types of reciprocal preferences (e.g., *liking* reciprocity, *continuation* reciprocity, and *guilt-aversion (and promises)* reciprocity). A detailed description of most of them is provided by Kolm (2008). For a discussion of *guilt-aversion* reciprocity see e.g. Charness and Dufwenberg (2006).

<sup>30</sup> Fehr and Gächter (2000, p.160) define “the cooperative reciprocal tendencies ‘positive reciprocity’ while the retaliatory aspects are called ‘negative reciprocity’”. Similarly, according to Gouldner (1960) and Fehr and Gächter (1998) *negative* reciprocity can be identified with the principle ‘an eye for an eye, a tooth for a tooth’.

distinguishes social norms from internalized norms where, as discussed above (see also chapter 1), the moral obligation comes from a cognitive process. The introduction of kerbside collection, for example, can advise citizens about the importance of recycling thus increasing their awareness about the problem and consequently their performance. However, if individuals are acting to obey an internalized norm rather than a social norm, the nature of sanctions for not complying may only be the consequence of negative self-evaluations, which come from the inside of the individual (and not from the society). Thus, it can be argued that, as compared to social norms and according to CET, an internalized norm is more likely to ensure that, when removing the regulation, behaviours will not be reversed. What was previously imposed by regulation is now, in fact, considered as a ‘standard’.

**Figure 2.2:** Environmental morale and ‘other-regarding’ theories



Many of these aspects will be discussed further in the following chapters. Having addressed the relevance of environmental morale for the success/failure of environmental policies, in what follows the analysis will be focused on describing specific conditions under which the relative price effect might dominate the crowding-out effect of intrinsic motivation. The identification of particular contexts where this occurs has important consequences for the efficiency of environmental

policies. However, before proceeding with that, the next paragraph provides a discussion about feasible areas where the problem of crowding-out can take place.

## **2.4 ENVIRONMENTAL MORALE AND THE CROWDING-OUT EFFECT**

### ***2.4.1 The role of the ‘low-cost argument’***

The limited approaches available in the literature about ideology in general suggest an inverse relationship between the net cost of pursuing ethics and the extent of environmental morale applied. In other words, the more environmental morale costs individuals the less they tend to apply ethics in real life contexts. As suggested by Frey (1997) when the costs are very high only ecological extremists will follow the principles of environmental ethics, while the remaining part of the population will find many reasons to desist to collaborate to the well-being of the ecosystem.

An interesting explanation of how it is possible to determine the cost of environmental morale under an external intervention lies in the seminal paper of Gawel (2006). Assuming that moral actions refer both to inner directed actions (i.e., actions intrinsically derived without any form of coercion or incentive), and to morally induced behaviour from external intervention it is possible to conclude that individuals’ behaviour is a result of the combination of two different effects namely the net effect of costs and benefits of decision’s options and the additional ‘inner satisfaction’. Moral actions will prevail only if the latter sum up with a positive net effect of the extrinsic sphere. If after the external intervention individuals experience a more advantageous situation (i.e., benefits) an incentive induced activity will become more attractive (relative price effect). However, the overall effect can differently produce the opposite result if intrinsic motivation is destroyed (or crowded-out). This is what determines the negative slope for environmental morale.

It turns out that environmental ethics as other moral behaviour is more likely to guide individuals' action in 'low-cost situations'<sup>31</sup>.

According to Frey (1997) and Gawel (2006) in modern economies relevant areas of intervention to boost environmental consciousness can be detected only in the private household sector – i.e., disposal and product-related policies such as recycling activities and consumption of 'green' products. The allocation of environmental goods, as well as transport-related behaviour and the diffusion of a responsible use of energy are instead generally considered high-cost situations in terms of the individual's private cost. Therefore in these circumstances it is difficult to rely on ethical motivation in guiding individuals' behaviours.

Regarding the competitive sector of firms, the idea that intrinsic motivation does not play an important role has generally been challenged in the literature, though many aspects of this area remain obscure. A central issue here is the claim that firms under perfect competitive market are struggling to afford the costs of acting environmentally-friendly (i.e., high-cost motive). A different line of argument is that behaving under 'green' considerations could be attractive for firms as they can make 'special profits' (see Frey, 1997). However, as suggested by Gawel (2006), these motives may reflect purely the consequences of a profit-maximization analysis and do not prove either the existence or the importance of intrinsic motivation. Although market actors (government, public, environmental activists) can play a role to influence the entrepreneurial sector thus increasing environmental consciousness, doubts still remain about the origin of this awareness. Indeed, awareness in this context can be either induced by the profitability motive or by moral considerations.

Moving to the national-international level, the harmful impact of economic growth on environmental conservation has forced many countries to intervene to

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<sup>31</sup> In line with the tax compliance literature, this does not exclude the possibility that individuals may comply (i.e., behave environmentally friendly) even when the costs of following ethical considerations are high. However, in line with Frey (1997) – see discussion above –, this seems more likely to apply to a minority of individuals (relative to the whole country's population) especially when the costs of complying can be very high (if not prohibitive). For some 'environmentally friendly' individuals, for example, the time and trouble costs of recycling activities (such as distance to a recycling centre, and the costs associated to specific equipment for recycling – e.g., biodegradable garbage bags and/or bins for specific waste collection –) can be considered as a deterrent to recycling.



prevent the deterioration of the environment and to avoid getting an unsustainable consumption of natural resources. Examples are the measures adopted by several countries after the introduction of the Kyoto protocol, which represent an important step in the process of reducing the negative impact of human behaviour on the environment.<sup>32</sup> In this sense moral considerations may also acquire more relevance in the entrepreneurial sector. However, even in these circumstances it is possible to argue that, rather than being related to moral considerations, these actions may reflect either the willingness to implement new economic sectors<sup>33</sup> or, alternatively, the necessity to meet specific national and/or international agreements.

The position of poor or developing countries is different. Here the ‘survival’ argument seems to play a major role. In this case the exploitation of the environment may be justified by the necessity to fulfil the needs of the population<sup>34</sup>. It turns out that the costs of environmental morale are extremely high. To give an example, it is difficult to expect that in the Maghreb regions people will stop producing energy for exportation (as this is one of the main economic resources of the country) although they might be aware that this represents one of the main causes of CO<sub>2</sub> emissions.

To sum up, the ‘low-cost argument’ seems to suggest that an evaluation of policy interventions to enhance environmental consciousness is more likely to be effective in the private household sector since conflicting arguments for the relevance of intrinsic motivation in the entrepreneur sector seem to arise.

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<sup>32</sup> The Kyoto agreement was initially adopted in 1997 and ratified later several times. The main feature of the protocol is that it commits (albeit previously suggested it) 37 industrialized countries and the European Community to reduce their emissions by 5 per cent relative to 1990 levels. After the introduction of the Kyoto protocol many countries have introduced eco-stimuli packages in order to boost the ‘green sector’ and reduce CO<sub>2</sub> emissions.

<sup>33</sup> Germany, for example, has decided to invest in renewable energy sources as they were considered strategic for the increase of economic growth. The German Environment Ministry specifically states that (see BMU, 2007, p. 17): “In order to prevent climate change, which mankind can no longer control, we must set in motion a third industrial revolution – by switching the global energy supply to sustainable resources.

<sup>34</sup> These considerations seems to be consistent with some of the main conclusions related to the Environmental Kuznets Curve (EKC) studies that show that developing countries are reluctant to introduce environmental target such those envisaged by the Kyoto protocol since they have numerous advantages in the polluting sector and their relatively low level of income cannot cope with the stringent regulation introduced in developed countries (see for example He, 2007).

### ***2.4.2 The efficiency of incentive instruments and the crowding-out effect***

The efficacy of environmental instruments depends therefore on how external interventions affect individuals' behaviour and on how important is environmental ethics for behaviour, which is determined by the related costs. Frey (1997) identifies four different combinations of this two elements according to which environmental policy produces specific outcomes that are summarized in Table 2.2. According to Table 2.2 the environment is preserved when:

1) There is low environmental morale and significant intervention. In this context, the cost of behaving according to environmental ethics is too high. Therefore it is possible to expect that environmental morale weakly affects (or does not affect) economic agents' behaviour. It turns out that the relative price effect of external incentives fully determines behaviours generating the predicted outcomes.

2) There is high environmental morale and insignificant intervention. Here subjects do not face any costs, and since intervention does not influence their behaviour the environment is preserved. This is what is generally called "voluntary behaviour". Environmentalists and non-economists include in this sector actions such as waste separation and disposal or care of public places. However, recent literature on recycling activities strengthens the idea that the separation of household waste involves personal costs albeit not very serious ones (see for example Bruvoll et al., 2002, and Callan and Thomas, 1997). In addition the necessity of reducing landfill waste is leading many countries to the introduction of monetary incentives. This generates important consequences in terms of reversing the above conclusions. In particular, the considerations connected with case (4) might better suit this situation. However, these aspects will be discussed further below.

**Table 2.2**

The interaction between environmental morale and external intervention

Environmental Morale			
Intervention	Insignificant	Low	High
		(3)	(2)
	Significant	Environment Destroyed	Environment Preserved
		(1)	(4)
		Environment Preserved	Ambiguous effect on the environment

*Notes:* Author's elaboration based on Frey (1997, p. 60).

By contrast the environment is destroyed when:

3) There is low environmental morale and insignificant intervention. This case depicts a situation where economic agents do not exert environmental morale because this will be too costly to them. Therefore the absence of any internal and external intervention generates a destructive effect for the environment. Possible examples are given by developing countries where people have low interest to behave environmentally-friendly and government intervention is little or even absent. Other examples are all areas where individuals are not able to establish a connection between their own behaviour and the possible outcome (e.g., global warming or the preservation of animal species). Acting according to eco-conscious behaviours becomes in these contexts very expensive. In addition, the public good nature of such problems makes it difficult for governments to intervene externally.

4) There is high environmental moral and significant intervention. Here understanding the interaction between the relative price effect and the crowding-out effect becomes very important. The question is whether it is predominant the destructive effect of intrinsic motivation or the relative price effect of the external intervention. The necessary condition for the occurrence of the crowding-out effect is therefore the presence of a certain level of environmental morale when external interventions are introduced. However, as suggested by Frey (1997) the outcomes derived from interventions depend on several conditions identified as prerequisites for the crowding-out effect. These prerequisites can be classified in two separate

groups according to the way they affect agents' behaviour: control-directed prerequisites and acknowledge-directed prerequisites.

#### ***2.4.2.1 Control-directed prerequisites versus acknowledge-directed prerequisites***

Control-directed prerequisites shift the individual locus of control from an internal to an external sphere by assigning the responsibility of the task to the principal (e.g., the government or the institution that is promoting the intervention). In this case intrinsic motivation is redundant and slowly disappears by means of a reduction in self-determination. The crowding-out effect is likely to occur when:

(a) There is a personalized relationship between agents. Therefore the more anonymous is the relation between economic agents; the lower is the strength of the crowding-out effect given that the intrinsic motivation to cooperate is weak<sup>35</sup>. In this case the disciplining effect plays a major role. However, the outcome depends on the peculiarity of the regulation. In the case of command and control instruments, for example, the relative price effect may be efficacious (through a disciplining effect) if and only if regulation states clearly what kind of cost (i.e., punishment) is associated to the violated environmental behaviour.

(b) The level of interest for the task is high. In other words, if individuals perceive a specific ecological issue is externally imposed when previously observed on a voluntary base, they will experience a severe loss of motivation. An example is given by the voluntary participation to ecological groups' activities.

(c) Rewards are contingent on behaviour. Here intrinsic motivation becomes superfluous since individuals are guiding their behaviour according to the relative price effect. In general, the adoptions of price-based instruments (i.e., taxes, fines, and subsidies) may send the wrong signal that cares for the environment has a price instead of being an individual responsibility. The introduction of subsidies, for example, may lead those who are willing to contribute on a voluntary basis to lose their intrinsic satisfaction given that they are receiving a payment. However, there is

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<sup>35</sup> For a critical discussion of anonymity in this context, see Gawel (2006).

not a general consensus on the idea that subsidies may be counterproductive. To give an example, when monetary transfers are introduced to enforce standards (i.e., command and control instruments), the relative price effect and the crowding-out effect can reinforce each other. This is because individuals are well informed about the outcome that the regulation wants to achieve and they know that by changing their behaviour they will receive monetary incentives. However, for many other reasons subsidies are disregarded as an ideal policy instrument<sup>36</sup>. In particular, many authors underline the importance of the undesirable effects of monetary incentives for the so called ‘Not In My Back Yard’ (NIMBY) problem. The NIMBY situation occurs when a locally unwanted project (such as a nuclear waste repository) is supported given that monetary compensations are offered to individuals (see for example Frey and Oberholzer-Gee, 1997). It turns out that the harmful impact of the undesirable project is not taken into account any more, leading to the crowding-out effect of intrinsic motivation.

Acknowledge-directed prerequisites can cause instead a sense of frustration given that previous efforts seem not to be acknowledged. In this case self-esteem is reduced and the crowding-out effect can occur when:

(a) The intervention is not designed to discriminate among economic agents with high and low environmental ethics. Frustration arises for those who act according to high environmental morale since they perceive the intervention as disregarding their commitment and competence, thus destroying their initial motivation. Interesting results in this context have been achieved by Grepperud (2007) who formally shows that for a social cost function a first-best solution could be reached under a discriminatory scheme, which would impose a tax depending on the level of environmental morale, with higher rate for those with low morale and *vice versa*.<sup>37</sup> However, this conclusion does not hold for a moral welfare function, for which voluntarism performs better. The introduction of a tax to improve the kerbside collection, for example, can be negatively perceived by those who are already

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<sup>36</sup> Among other reasons, subsidies may provide an incentive to increase pollution for those who were not polluting to benefit from the monetary incentive. For a detailed description of them, see Frey and Stutzer (2006) and Gawel (2006).

<sup>37</sup> In particular, those with low morale will receive a Pigouvian tax, whilst those with higher environmental morale will receive a Pigouvian tax less the ex-post marginal voluntary utility.

recycling, thus crowding-out their self-determination. Individuals may think that the authority does not acknowledge their actual contribution and they are therefore overjustified to maintain the same level of motivation. Nevertheless, a different result can be expected if instead of imposing a tax the local authority introduce a fee on those who are not recycling. This is because only those who are initially reluctant to recycle will pay the price of receiving the service.

(b) The intervention fails to acknowledge the agents' intrinsic motivation. Tradable permits, for example, allow for a specific amount of pollution, but do not morally punish polluters as long as they do not overcome established limits. In other words, tradable permits introduce a sort of licence to pollute. In this sense environmentally intrinsic concerns seem to be irrelevant (see Frey, 1997), as "it is acceptable to sin, provided you pay for it" (Frey and Stutzer, 2006, p. 15). As in the case of environmental taxes, the relative price and the crowding-out effects follow an opposing direction and the latter dominates the former. However, in this context the crowding-out effect of the tradable permits might be even stronger as, unlike the case of environmental taxes, these instruments do not send the signal that polluting the environment is an undesirable activity.

## 2.5 CONCLUSIONS

The discussion outlined provides insights into the importance of environmental morale as the intrinsic motivation to contribute to a better environment. On the one hand, environmental morale can increase the demand for a clean environment and for 'green' products. On the other hand, it can help to overcome the free-riding problem that is embodied in the provision of pro-social behaviours.

In this context, intrinsically motivated people with 'other-regarding' preferences may also play an important role. Altruists voluntarily will contribute to the provision of environmental goods not only because of their warm glow of giving, but also for the sake of others' well-being. Similarly, reciprocal preferences can be of crucial importance for the support and enforcement of social norms and external regulations. This is particularly so in the case of *strong* and *positive* reciprocity. Finally, the

disposition to observe social norms may also boost individuals' motivation to contribute to environmental preservation.

The literature on environmental morale and the crowding-out effect suggests that external intervention can undermine morale motivation. In line with the more developed analyses on the provision of public goods, there are many situations in which extrinsic incentives are expected to lead to counterproductive effects. However, the lack of specific empirical evidence in this area of research cannot support the conclusions outlined and summarized in this chapter.

The importance of the 'low-cost argument' implies the necessity to understand the interaction of price-based instruments (i.e., subsidies, taxes and fines) and intrinsic motivation. Specifically, under which conditions will these instruments undermine morale motivation? Is there any case where intrinsic motivation is strengthened by a particular price-based instrument? CET indicates that if an instrument is perceived as controlling, environmental motivation can be undermined. In addition if individuals understand the instrument as 'a means to reach an end' it might be argued that intrinsically motivated behaviours will be discouraged. However, if the instrument is judged as acknowledging and supportive, intrinsic motivation can be reinforced. The introduction of a fine or a tax, for example, makes every polluter pay at least a little, so that complete free-riding no longer holds. This can certainly enhance conditional co-operators' motivation given that now they will not feel exploited by others. Based upon these considerations, it is possible to conclude that price-based instruments do not always undermine moral motivation. However, if this is the case the following questions can be raised. That is, is it better to leave the care of the environment to the voluntary contribution of intrinsic motivated individuals? Or would it be better to intervene with specific policies that take into account a more psychological actor –i.e., *homo realitus*? If, on the one hand, sceptics about voluntary contribution will argue that, even if substantial, this cannot bring the economy to its first-best situation – which might explain why certain environmental problems (e.g. greenhouse emissions, and preservation of particular species of animals) are still in need of a solution –; on the other hand, for governments and institutions that support price-based instruments, it might be even

more challenging to design specific environmental policy measures that take into account the wide variety of reasons that motivate individuals' behaviour.

As with other areas of research, small-scale experiments and survey analyses might be useful to gather information about individuals' attitudes towards the environment under different regulatory schemes. Given the scarce contribution in the literature analysing these issues, a specific study in this context could be of fundamental importance to shed light on particular solutions to overcome the free-riding problem and to understand the motivations that encourage individuals to eco-conscious behaviours. These issues are addressed and discussed in the next chapter.



## Chapter 3

# ECONOMIC INCENTIVES AND ENVIRONMENTAL MORALE: AN EMPIRICAL INVESTIGATION OF RECYCLING

*Do the ends justify the means?*  
*Niccolò Machiavelli (The Prince, 1532).*

### 3.1 INTRODUCTION

Neoclassical theory regards environmental degradation as a specific type of ‘market failure’ (Pearce, 1976). As such, welfare economics in general and cost-benefit analysis in particular provide an understanding of what an ‘optimal’ configuration of an economy would look like in terms of a reduction of environmental damages. Methods of securing an ‘optimal’ amount of pollution and resource exploitation of non-renewables, as well as resource conservation are generally addressed in the literature as possible ways to reduce environmental degradation. Recycling represents a key component in this arena. Indeed, it can be considered the ‘most widely entertained mechanism for extending the life of a resource’ (Pearce, 1976, p. 168).

The ‘optimal’ impact of human activities on environment conservation and non-renewable resource exhaustion widens the analysis of environmental degradation to include efficiency as well as equity aspects<sup>38</sup>. Regarding recycling, this therefore includes the questions of how an optimal recycling rate should be as well as what is its impact on future generations. Likewise other ‘green’ activities (e.g., pollution reduction), neoclassical theory predicts that the optimal recycling rate should be reached at a point where the marginal costs of recycling equals the marginal benefits. However, there are a number of limitations in the use of the ‘optimal’ recycling approach in this way.

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<sup>38</sup> Equity refers to the impact of environmental degradation on future generations, and efficiency is related to Pareto efficient allocation of resources (for a discussion see Pearce, 1976, and Perman et al., 2011).

Looking at the entrepreneur sector (see Pearce, 1976), for example, if on the one hand for many pollutants the costs of recycling might exceed its benefits (e.g., toxic metals), on the other hand, for some wastes the ‘optimal’ level of recycling might not coincide with the maximum amount of recycling that technology permits. Similarly, in the private household sector, since it is generally agreed in the literature that recycling is not a costless exercise, individuals might choose their recycling level according to strategic considerations (e.g., although individuals might be enthusiastic about recycling, they might decide not to recycle when the opportunity cost of participating is too high). These problems can be exacerbated by the fact that both in the entrepreneur and household sectors the private decision to recycle generally ignores the social costs (e.g., increase of required external inputs for the recycling process) and benefits of recycling (e.g., extension of resource life, pollution reduction, and reduction of demand of landfill sites).

This is what renders in practice recycling a complex issue and might explain why, despite the numerous efforts made at the national and international levels to encourage recycling, the current perception in modern economies is that people and firms still seem hesitant to adopt separate collections. As such, this introduces the problem of how to incentivize people to recycle, and, given the discussion outlined in Chapter 2, also raises the question of understanding how people react to different government signals (i.e., instruments) according to their underlying motivation (i.e., environmental morale).

The present study seeks to make a contribution to this area of research and to identify conditions under which incentives may crowd-in/out environmental motivation. To examine these themes, a large sample of students took part in a survey designed to gather information on how environmental morale can be connected with individuals’ attitudes towards recycling under different policy interventions, and to investigate the direction of its linkage with ‘other-regarding’ theories, such as social norms, reciprocity, and altruism.

The description of the survey will be the focus of this chapter, whereas a detailed analysis of the empirical results will be presented in the following chapter. The next

section describes the rationale and aims of the survey analysis. It is followed by a brief outline of the recent literature on recycling and intrinsic motivation. Section 3.4 describes the methodology and the questionnaire. Brief concluding remarks are presented in section 3.5.

## **3.2 RATIONALE AND AIMS OF THE STUDY**

Given the importance recycling activities are afforded nowadays<sup>39</sup>, they provide a rich area for investigation. The purpose of this study is to consider information about people's attitudes towards recycling participation. As noted in the previous chapter, incentives can be either acknowledging (or effective) or controlling (and less effective). In general, when external regulation is perceived as 'a means to reach an end' (e.g., Pigouvian taxes, subsidies, and fines) intrinsic motivation may be crowded-out. By contrast, a 'supportive' policy may direct people towards desirable behaviour<sup>40</sup>. In this light, the analysis considers three different instruments: a voluntary scheme, a facilitating *nudge* scheme, and a mandatory scheme backed by a fine. The first two hypotheses to be tested are:

*Hypothesis 1:* Individuals' reaction to government policies is sensitive to the nature of signals (e.g., acknowledging versus controlling regulation).

*Hypothesis 2:* The extent of individuals' reaction to government policies depends on their level of environmental morale.

According to Grepperud (2007), it is reasonable to expect that those who initially have a higher environmental morale would not be positively affected by any policy – i.e., they can be either discouraged to persist in their behaviour or neutral. However, in practice it can be expected that even those who are initially environmentally friendly can become more motivated to contribute to a better environment when

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<sup>39</sup> The EU's Sixth Environmental Action Programme (EAP) set waste management as one of a major priority of the European Commission. 'The three Rs strategy (i.e. Reduce, Reuse and Recycle)' represents nowadays the guideline of all actions taken at the national/international level to prevent and reduce waste generation (European Commission, 2001).

<sup>40</sup> According to the Kantian philosophy, a desirable behaviour could be compared to a universal morale maxim that should be independent of individuals' identity and of any other physical aspects (see Kant, 1785).

others are encouraged to do so. As mentioned in Chapter 2, the introduction of economic incentives can lead conditional co-operators to feel no longer exploited by others, thus increasing their contribution towards the environment. Therefore, a further aspect to investigate is whether monetary incentives affect only those people with an initial low environmental morale.

The nature of *homo economicus* has been examined both at the individual level in studies of interpersonal cooperation (see Frank et al., 1993, and Yezer et al., 1996) and tax evasion (see, Lewis et al., 2009), and at the cultural level in studies of tax evasion (see, Alm and Torgler, 2006, and Lewis et al., 2009). This study pursues a similar evaluation with respect to environmental policies. The hypothesis to be tested here is that, among other things:

*Hypothesis 3:* Individuals' behaviour depends on differences in individuals' sensitiveness towards environmental issues and cultural differences.

Previous works (see Lewis et al., 2009) indicate, in fact, that instrumental behaviour depends on attitudes, values and culture. A number of papers in behavioural economics suggest that economics majors act more selfishly than those who have other majors (e.g. 'other social sciences')<sup>41</sup>. Surveys (see Frank et al., 1993) and laboratory experiments (see e.g. Marwell and Ames, 1981, Kahneman et al., 1986, and Selten and Ockenfels, 1998) highlight for example that male economists tend to contribute to public goods less than male non-economists. Recent studies show that this tendency is not only due to different indoctrination (which suffers from 'identification problem' criticisms)<sup>42</sup>, for which "exposure to the self-interest model commonly used in economics alters the extent to which people behave in self-interested ways" (Frank et al, 1993, p.159). Self-selection, meant as a natural way for individuals of pursuing their own interest (against others' well-being), seems also to play an important role (Frank and Schulze, 2000). Given these considerations, economists may not be representative of the student population especially when drawing conclusions in situations that require a trade-off between profit

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<sup>41</sup> According to Frank et al. (1993), other social sciences include psychology, sociology, political sciences, and anthropology.

<sup>42</sup> See Yezer et al. (1996).

maximization and ethical considerations (Cipriani et al., 2009). Thus, at the individual level the questionnaire aims to shed light on the self-regarding and instrumental attitudes of people who study economics and those who study psychology.

At the cultural level, the survey offers a cross-country comparison between respondents in Italy and the UK. According to the latest available statistics (see Appendix 3A), although in the past decade the recycling sector has massively increased in both the UK and Italy, the UK performed better than Italy<sup>43</sup>. There is reason to believe that these differences may not only be due to the financial constraints faced by the two countries with respect to recycling activities. Among other reasons, it can be argued that these variations might be due to late (or lack of) public acceptance of separate collections, which can be attributed to differences in culture and in individuals' level of environmental morale. Many studies in the tax compliance literature show, for example, that the higher is tax morale in a country the lower is the level of evasion. Thus, if moral motivation plays a role, it is reasonable to argue that in countries where there is a high level of environmental morale, subjects will be more willing to contribute to the conservation of the environment. Torgler et al. (2008), analysing individuals' preferences towards the environment in 33 countries in Western and Eastern Europe, provide evidence that people are willing to contribute to a better environment through different channels – i.e., monetary payments (such as taxes or income donations) or voluntary work. It turns out that people behave differently in different cultures. Among other reasons, this can be related to the level of individuals' environmental morale as well as to their perception of fairness and legitimacy of governments. Therefore, the present analysis tries to assess: whether Italian and British students contribute differently to recycling activities; and whether these differences can be attributed to differences in culture and in the levels of environmental morale.

Among the methodologies that can be used to analyse environmental preferences, primary data in general and surveys in particular have the advantage of being able to employ many independent variables and therefore to control for specific factors

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<sup>43</sup> Some 24.7 per cent of total waste generated in the UK was recycled in 2011, against 19.6 per cent recycled in Italy (excluding composting and digestion).

explaining individuals' behaviours. As it will be discussed further below (see also Chapter 1), this provided us a unique opportunity to use specific questions to build the environmental morale index, a variable that was not possible to obtain if relying on E/WVS data. Compared to laboratory experiments, which generally involve only a few number of participants (maximum 24 per each session of the experiment), surveys also have the advantage of being able to provide large data sets for regression analyses. Given the different objectives of this study, the employment of experimental data could have prevented us to gather significant results from the empirical analyses. Furthermore, *ad hoc* surveys are generally useful in providing comparisons between different countries and might be particularly helpful to overcome the problem of unavailability of data from different sources. In line with other areas of research attempting to obtain information about individuals' preferences<sup>44</sup>, this work will take advantage of these features of survey evidence. Some economists seem to be sceptical about survey results given that respondents' answers might be biased "towards what they perceive as socially acceptable or normal behaviour" (see Frank and Schulze, 2000, p. 103). However, the present study uses questions on hypothetical scenarios rather than asking people questions about their actual behaviour. This may help in reducing the problem of bias. This aspect will be further discussed in the concluding section of Chapter 4 along with possible limitations of the study.

### 3.3 INTRINSIC MOTIVATION AND RECYCLING

Recent contributions to the literature offer insights into the importance of environmental morale and motivation for recycling behaviour. As suggested by Nyborg (2008), on the one hand cognitive evaluation theory and the more recent self-image approach provide arguments in favour of the crowding-out effect. Cognitive evaluation theory is concerned with actions individuals are willing to undertake even in the absence of external interventions – i.e., they are intrinsically motivated. In contrast, the self-image approach assumes that individuals are not aware of their moral values, but they can learn how good they are by observing their own behaviours.

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<sup>44</sup> Surveys have been largely used to analyse tax morale (Klepper and Nagin, 1989, Orviska and Hudson, 2003, Torgler, 2005) and happiness (see for example Frey and Stutzer, 2002).

Pioneered by Bénabou and Tirole (2006) the self-image approach implies that, when making decisions, individuals are influenced by a mix of intrinsic, extrinsic and reputational motivations that are context related. In the words of Bénabou and Tirole (ibid, p. 1653) people's behaviour is "influenced by a strong need to maintain conformity between ones' actions, or even feelings and certain values...they seek to uphold". It turns out that individuals care about their self-image and assess their own conduct through the eyes of an impartial spectator by imagining how he/she would evaluate it. Placing their self in his/her situation they develop feelings of approbation/disapprobation and accept or condemn actions according to different passions and motives. However, later on they will lose some information about their values given that there will be incentives to recall them in a self-serving way (see Bénabou and Tirole, 2006). In other words, actions will be easier to remember, and individuals will define themselves according to their past actions.

In this light, contributing to the environment might increase individuals' confidence in their own goodness. However, when external interventions are substantial enough to keep emissions at a socially optimal level (e.g., a Pigouvian tax) moral motivation is crowded-out since people believe that their contribution may not be worth very much. These arguments are in line with a theoretical model introduced by Brekke et al. (2003). The authors provide a formal proof of the effect of introducing either a *symbolic* fee (i.e., introduced merely as an incentive) or a *sufficient* fee (i.e., introduced to fully finance external provision of the good) to boost individuals' motivation to perform tasks that were previously done on a volunteering do-it-yourself basis. In the first case the fee is perceived as encouraging responsible individuals to increase their efforts. In the second case, individuals erroneously believe that responsibility of the public good provision is left to the government, leading therefore to a reduction of their contribution. This differs in some way with cognitive evaluation theory (see Deci and Ryan, 1985) that generally assumes that external interventions reduce morale motivation when individuals perform interesting tasks and perceive monetary incentives as controlling. However, as Brekke et al. (2003) point out, moral motivation here is not only narrowly related to interesting tasks, but to morality as such. Thus, the key concept is the individuals'

trade-off between the benefits of maintaining a self-image of being socially responsible against the costs of doing so. This is done by evaluating individuals' *actual* and *morally* ideal efforts. A case study relating to *dugnads* (voluntary community work) in Norway shows that when a fee for non-participation was introduced individuals were more willing to decrease their work participation.

On the other hand, cognitive dissonance suggests that individuals experience a negative feeling when behaviour is in contrast with their positive self-conception as good people (Aronson et al., 2005, cited by Nyborg, 2008). According to the self-image model developed by Brekke et al.(2003), cognitive dissonance can be reduced by adapting actual behaviour. However, the psychology literature suggests that in order to reduce the unpleasant feeling of cognitive dissonance a change in one's values rather than behaviour is much more effective. In particular, individuals tend to be more prone to change their values if it becomes costly to support a moral idea (see Ostling, 2009). In such a context, introducing an environmental tax makes it less costly for individuals to be environmentally-friendly, thus reinforcing their moral values. In addition, according to theories based on reciprocity and conditional cooperation it seems that the introduction of green taxes may keep up the moral motivation of the conditional cooperators as opposed to free riding behaviour.

These considerations suggest that while moral motivation seems to be crucial for environmental protection when Pigouvian instruments cannot be applied, it is much less clear how intrinsic motivation interplays with efficient and feasible monetary incentives (Nyborg, 2008).

Even though many studies in the literature cite moral motivations as a possible explanation for differences in voluntary recycling<sup>45</sup>, the influence of environmental regulation on environmental morale has been analysed more theoretically (see for example Grepperud, 2007). As a matter of fact, a large body of the theoretical and empirical studies have been mainly focused on the analysis of the determinants and the variation in recycling behaviours. Some of them discuss the importance of households' recycling efforts as a social cost and examine the extent to which these

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<sup>45</sup> This has been especially done in studies that considers recycling as a pro-social behaviour (see for example (see Hopper and Nielsen, 1991, and Thøgersen, 1996).



costs should be taken into account in cost-benefit analyses for alternative waste treatment systems (Bruvoll et al., 2002, Berglund, 2006). Some others analyse empirically the determinants of the differences in demand for waste disposal and recycling within and across countries based on different policies adopted to encourage these behaviours (Callan and Thomas, 1997, Jenkins et al., 2003, Kipperberg, 2007, Abbot et al., 2011). An emerging empirical literature refers instead to the self-image approach (see Brekke et al., 2003) as a possible explanation for recycling and/or for individuals' reaction to public policies. Thus, in the survey conducted by Brekke et al. (2003), the introduction of a kerbside pick-up system to collect households' waste leads to a substantial proportion of subjects considering increased efficiency as a disadvantage for them. In the study presented by Brekke et al. (2007), duty-oriented individuals are guided, instead, by responsibility ascriptions that influence their self-image. Responsibility here is not considered as a mere choice but as an inference, meaning that when individuals are not sure about the right thing to do they follow others' behaviour. The authors find a positive relationship between duty-based individuals and recycling behaviour.

However, to the best of the author's knowledge, there seems to be only one study that directly examines the mechanisms that tend to erode (or encourage) moral motivation and contributions to recycling activities using multiple instruments (Feldman and Perez, forthcoming)<sup>46</sup>. Differently from the current study, Feldman and Perez (*forthcoming*) consider deposit, a mandatory scheme and voluntary contribution as external incentives. The authors point out the potential regulatory advantage of using deposit schemes over other instruments. Drawing on this finding, they conclude that the design of recycling policy should be sensitive to the framing of regulatory instruments and to the interplay between intrinsic and extrinsic motivation on the desirability and efficacy of the policy schemes.

The scarce empirical evidence on the relationship between intrinsic motivation and recycling participation might be due to problems in disentangling behaviour arising from intrinsic and extrinsic motivation using secondary (rather than primary)

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<sup>46</sup> In a relatively recent study, Thørgersen (2003), for example, considers only the effect of introducing a pay-by-weight scheme for garbage collection on individuals' willingness to recycle.

data. It might be difficult, for example, to understand whether a voluntary behaviour is related to *other-regarding* preferences or to moral issues. However, since most of the theoretical analyses conclude that it is better to leave individuals' compliance to voluntary behaviour (due to the crowding-out effect on moral motivation); more evidence on these issues represents a priority for economic research. This, in fact, seems to be in contrast with actual governments' interventions aimed at increasing citizens' effort in various ways. In addition, it seems hazardous to over-generalize and attribute the above conclusion to all types of environmental activities. One might expect, in fact, that moral motivations are *context-related* and depend on the nature of the activity.

Furthermore, it might be the case that external interventions have a positive impact on intrinsic motivation as their presence might strengthen social norms, thus leading to a possible positive long-term effect<sup>47</sup>. As suggested by Rege (2004) in a different context temporary taxes or subsidies might be sufficient to reach a permanent Nash equilibrium. Therefore the introduction of external interventions and their subsequent removal would not alter individuals' perception that recycling is the right thing to do. However, such a long-term effect requires both that people exhibit different initial environmental morale (to create different equilibria) and that the percentage of individuals with high environmental morale is sufficiently increased after the tax and subsidy removal (for a similar discussion about green consumers' attitudes, see for example Nyborg et al., 2006, p. 359 ).

These aspects will therefore be taken into consideration in the present study.

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<sup>47</sup> This may occur, for example, if individuals perceive it as "a symbolic device underlining the individual's responsibility" (see Nyborg et al., 2006, p.359).

## 3.4 METHODOLOGY AND DESCRIPTION OF THE QUESTIONNAIRE

### 3.4.1 Procedure

The empirical analysis presented here is based on a questionnaire survey conducted in the cities of Bath (United Kingdom) and Florence (Italy). Before proceeding with the collection of the questionnaires two pilot analyses<sup>48</sup> were carried out. After introducing the necessary changes a final version of the questionnaire was built according to respondents' suggestions and field-experts' opinions.

The survey was administered by the author during the periods October-December 2011 and February-April 2012. The questionnaires were collected from students taking first year courses in psychology and economics at the University of Bath (UK) and at the University of Florence (Italy) according to the following procedure<sup>49</sup>. After a brief introduction to the study, participants received a printed version of the questionnaire. The following preamble was read out:

‘There are many reasons why governments are promoting recycling activities. In particular, they are aimed at reducing: waste to landfill; excessive consumption of raw materials; methane emissions; water contamination; and odours and noise pollution.

The purpose of this questionnaire is to gather information on people's attitudes towards recycling activities. The questionnaire is divided into three different sections. In ‘SECTION 1’ you are requested to answer questions about hypothetical

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<sup>48</sup> The first pilot analysis involved a sample of 100 respondents interviewed among the student/adult population of the University of Bath and of the University of Florence. The second one included approximately 50 students recruited among the student population of the University of Bath.

<sup>49</sup> It has to be noted that some of these students were not strictly ‘economists’ or ‘psychologists’ (e.g., a minority of students – roughly one-third of the sample interviewed – taking first year courses in economics at the University of Bath were politics majors). However, for simplicity they will be referred to as ‘economists’ and ‘psychologists’, respectively. Note that pooling the data obtained from students who were exposed to (and not strictly enrolled in) the economics and psychology courses seems not to represent a major problem here. Indeed, the objective of the study was not to test whether differences between students' behaviours and attitudes are due to self-selection (see e.g., Frank and Schulze, 2000), but to investigate whether differences between students' responses are consistent with exposure to different indoctrinations.

scenarios regarding recycling activities. Each setting varies according to different policies introduced by the local authority, which is officially responsible for the provision of public services in your area. Remember these are imaginary situations that do not have to be necessarily related to your actual personal experience. In ‘SECTION 2’ and ‘SECTION 3’ you are asked to provide general information about yourself and to state your opinion on particular issues.

To answer the questions, please tick ONE of the boxes next to the answer(s); or, when appropriate, write your answer in the space provided. Unless the question allows you to tick more than one answer, please just tick one box per question.

I would be very grateful for your contribution to this study. All responses will remain anonymous. Thank you for your help.’

Participants were then asked to complete the questionnaire on their own and without consulting their colleagues. The time taken to hand out the questionnaires, and to complete and collect them again was approximately 20 minutes. In all 1,190 responses were collected. Data from 25 participants were excluded. Among them, 10 did not complete the questionnaire, 8 answered all questions without following the instructions provided in the answers (next to each option), and the remaining 7 provided answers that were not consistent with the structure of the questionnaire (e.g. they answered question Q3.b after choosing ‘I would increase my effort’ in question Q3)<sup>50</sup>. After omitting these data the full sample is based on 1,165 observations for the regression analysis (60% economists, and 40% psychologists). Main sample characteristics are reported in Table 3.1. As shown in the table, the sample is generally balanced: 377 observations constitute the Italian-economists subsample, 325 comprise the British-economists subsample, and of the remaining 463 questionnaires collected, 253 were taken from psychology lectures at the University of Bath and 210 were gathered from psychologists at the University of Florence. The questionnaire is reproduced in Appendix 3B.

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<sup>50</sup> This provides evidence in support of the conclusion that generally respondents understood the questionnaire.

### 3.4.2 Dependent variables

In the first part of the questionnaire (i.e., ‘SECTION 1’) participants were asked to answer questions on three hypothetical scenarios. Answers to these questions were aggregated into a scale that served as dependent variables for the regression analysis. In the first setting (hereafter VOLUNTARY scenario), respondents were asked to assess their level of contribution in terms of effort spent on recycling activities given the assumption that they had to bear the time and trouble costs of recycling activities (e.g., separate their waste and/or buy different bins and garbage bags for specific waste). Responses were based on a five-point Likert scale (from 1 = I will do hardly any recycling, to 5=very high).

**Table 3.1**  
Sample characteristics

TNO	Economists	% TNO	Psychologists	%TNO
Italian sample	377	53.7%	210	45.4%
British sample	325	46.3%	253	54.6%
Full sample	702	60.3%	463	39.7%

*Notes:* The table reports sample characteristics of data collected from Economics and Psychology taught units at the University of Bath (British sample) and at the University of Florence (Italian sample). TNO = Total Number of Observations. For the full sample, % TNO refers to the percentage of students exposed to Economics and Psychology teaching relative to the total number of observation in the data set (i.e., 1,165). For the two subsamples of observations (namely, the Italian and British samples), % TNO refers to the percentage of students studying Economics and Psychology in Florence and Bath relative to the total number of Economics and Psychology students in the whole sample (i.e., 702 and 463, respectively).

In order to understand which reason was the most important for their decision over the alternatives ‘high’ and ‘low’ provision of effort, two follow-up questions were also asked<sup>51</sup>. The alternatives provided in the answer were based on the most common factors mentioned in the literature as possible explanations for pro-environmental behaviours (see Barr, 2003, and DEFRA, 2002). In particular, the present analysis considers:

- *Awareness* (i.e., ‘I believe environmental damages caused by not recycling are significant/insignificant’), which seems to be one of the crucial factors for active engagement of citizens towards more sustainable behaviour. It turns out that

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<sup>51</sup> Given that the same reasons may apply for a medium provision of effort, those who chose a medium provision of effort were asked to select one option among the possible alternatives presented in the follow-up questions related to high and low provision of effort.

increasing general consensus and awareness for the need to recycle represent a core priority for governments. This should be guaranteed not only by appropriate information-campaigns about the separation of waste but also by public accessibility to specific (scientific) documents, which recognize the need for the necessity of environmental actions and guide local and national policies. Among other factors, Barr (2003), for example, in a survey conducted in Exeter, found that those respondents who were more concerned about waste issues (and perceived it as a threat for their personal wealth) were more willing to reduce the waste that they produced.

- *Appropriate information-campaigns* (i.e., 'I am/I am not well informed about waste recycling collection), which is strictly connected with the concept of awareness, as it seems to represent one of its casual attributions. In a relatively recent report DEFRA (2002, p.7) states that 'through informed dialogue, appropriate solutions can be found to complex problems involving many different issues.' However, it might be argued that in some circumstances information is unlikely to be effective without actions directed to develop an environmental consciousness. This is specifically the case of recycling activities. To give an example, if a good information campaign is employed in order to explain to citizens how to separate specific waste, but individuals are myopic about the necessity and significance of their actions, the information alone would be less likely to generate the desirable outcomes. This justifies the need to separate the two factors in order to evaluate which one plays a major role in engaging/not engaging in recycling behaviour.

- *Social pressure* (i.e., 'I do/I do not participate in recycling activities because others do so'), that is the acceptance of the norm to recycle given that others do participate in such activity. Many studies in the literature provide evidence for the importance of this factor in recycling behaviour. Barr (2003) and Brekke et al. (2007) for example show a positive relationship between individuals' participation in recycling and the degree to which other households' behaviour is observable.

An open answer option (i.e., ‘Other reasons’) was also provided to allow respondents to answer in their own terms and to locate other factors influencing voluntary contribution to recycling activities.

The VOLUNTARY scenario represents a benchmark situation designed in order to facilitate comparisons with two other scenarios where individuals’ behaviour was designed to be driven by external incentives enforced by a local authority. The choice of these scenarios reflects the on-going debate over the mandatory/voluntary nature of recycling activities<sup>52</sup> *versus* a more (liberty-preserving) paternalistic strategy that tries to direct people’s behaviour towards recycling (see Thaler and Sunstein, 2008). The second scenario (hereafter BIN scenario – i.e., a facilitating *nudge* policy), was modelled, in fact, with the objective of sending the signal that recycling is the ‘right thing to do’, thus acknowledging individuals’ contribution to recycling but preserving their freedom to choose not to recycle. To this end, this setting considers improving the provision of kerbside collection without charging any fees<sup>53</sup>. Besides these improvements, the third framework (hereafter FINE scenario – i.e., a mandatory scheme) introduces a money fine on those who are caught not recycling as requested. Similar to other areas of research (e.g., see the tax evasion literature), the FINE scenario seems to pose the problem of introducing a risk element into the analysis. Therefore it might be argued that a decrease in the provision of effort could be biased by individuals’ misperception of the probability of being detected not recycling rather than from the crowding out effect. However, the fine here serves as a *vehicle* to avoid responsibility costs (i.e., time and trouble costs) contingent on recycling activities, rather than just as a punishment for not recycling as requested<sup>54</sup>. Therefore, these aspects do not play a major role here. In addition, unlike the tax evasion literature, the fine is independent of the amount of non-recycled waste and it is fixed to the local littering fine. Thus, the decision on

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<sup>52</sup> In the UK, for example, *The Sunday Telegraph* has supported a strong campaign against the introduction and maintenance of fines contingent on recycling non-compliance. Examples of penalty schemes introduced in UK are those who allow councils to fine people between a minimum of £110 to a maximum of £1000 (e.g. in Lambeth). In Italy most of these schemes have been introduced in 2011 in many municipalities from the North to the South of the country (e.g. in Trento, Ponsacco, and Cagliari) and penalties varies between 150 to 500 euros.

<sup>53</sup> It is worth emphasizing that given the hypothetical nature of the questions, *nudge* is here referred to the signal (or perception) of government intervention rather than to a real stimulus as suggested in Thaler and Sunstein (2008).

<sup>54</sup> For similar approaches see Gneeze and Rustichini (2000b), and Bruvold et al. (2002).

whether to decrease/increase private contribution or not may reflect intrinsic motivation related to the activity itself rather than being dependent on the amount and intensity of the fine.

In both scenarios respondents were presented with a question where they were asked to compare the new situations with that presented in the first setting. Thus, they were required to think about whether the changes provided by the new scenarios would in some way affect their behaviour. The assumption here is that individuals may react in different ways to different policies (i.e., signals). In particular, external interventions may either reduce/increase individuals' motivation and effort or not influence individuals' behaviours at all. Possible responses to these questions were: 'I would exert the same level of effort', 'I would increase my effort', and 'I would decrease my effort'.

In order to provide possible explanations for respondents' decisions and to capture the reasons for the crowding-in/out effect, two follow-up questions for the 'I would increase my effort' and 'I would decrease my effort' options were used<sup>55</sup>. Depending on the context, the answers provide a mixed combination of a disciplining effect motivation, a crowding-in/out motivation, a social pressure explanation (i.e., 'I believe others will do so') and a general open answer (i.e., 'Other reasons'). These reflect theoretical explanations provided in the literature for increasing/decreasing individuals' effort (see e.g. Frey, 1997).

The disciplining effect motivation used in this analysis comprises possible instrumental considerations individuals may take into account when the external intervention increases marginal shirking costs (e.g., using a mandatory scheme) or decreases marginal costs of performing (e.g., facilitating *nudge* policy). In both cases the disciplining effect raises individuals' performance<sup>56</sup>.

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<sup>55</sup> Since the study mainly focuses on the crowding-out/in effect, no follow-up question was built for the answer 'I would exert the same level of effort', where individuals are indifferent to policy changes. Possible explanations for this could be either that they are already providing their maximum level of effort or they do not exhibit any form of initial motivation.

<sup>56</sup> Here the crowding out effect is neglected because intrinsic motivation is considered to be a constant or, alternatively, absent. For a discussion see e.g. Frey (1997).



The crowding-out effects are captured by two different types of reasoning: one assumes that instrumental considerations play a major role in determining a decrease in individuals' performance when others, including Government, increase their efforts (i.e., typical public good crowding-out effect<sup>57</sup>); the other one is more related to intrinsic motivations (see Frey, 1997 – hereafter the Frey's crowding-out effect) and to the extent to which external regulations affects performance *via* a reduction in individuals' self-determination and self-esteem.

Finally, in both scenarios the crowding-in effects (see Frey, 1997 – hereafter the Frey's crowding-in effect) are driven respectively by *positive* and *strong* reciprocal preferences (see Nyborg, 2008). As discussed in chapter 2, on the one hand, *positive* reciprocity predicts that those who perceive the policy improvement as a fair and acknowledging policy will enjoy increasing their contribution. People, for example, can feel gratification from responding in kind to an improvement of recycling materials and services. On the other hand, when introducing the fine, *strong* reciprocal preferences might increase the intrinsic motivation of conditional co-operators who no longer feel exploited by free riders.

The current study has therefore the advantage of being able to disentangle behaviours induced by instrumental evaluations (i.e., disciplining effect and public good crowding-out effect) from those induced by ethical considerations (Frey's crowding-out/in effect). Table 3.2 summarizes the options used to capture these effects in the BIN and FINE scenarios.

Overall this comprises a combination of  $5 \times 3 \times 3$  possible behaviours. Among them, it is interesting to isolate those that can be attributed to *social men*, from those ascribed to *economic men*. In this context a *social man* is a man that voluntarily contributes to recycling activities (and presumably has an initial intrinsic motivation), whilst an *economic man* is a man who does not care about recycling

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<sup>57</sup> For a discussion see Andreoni (1989, 1990).

activities and seemingly about the environment (and presumably has a low or no environmental morale)<sup>58</sup>.

**Table 3.2**

The interaction between intrinsic and extrinsic motivation and the relative change in efforts

The interaction between intrinsic and extrinsic motivation and the relative change in efforts			
Change in effort, relative effects	Disciplining effect	Crowding-in effect	Crowding-out effect
Bin Scenario			
Increase	Recycling will be less time and effort consuming	I am happy to spend more effort if recycling facilities increase (Frey's crowding-in effect) <sup>a</sup>	-
Decrease	-	-	- Recycling (or not) should be an individual choice and not treated as an almost moral obligation (Frey's crowding-out effect)
			- I would put in less effort because I can achieve the same quantity of recycling as before given the improved recycling activities (Public good crowding-out effect)
Fine Scenario			
Increase	I will increase my effort because I do not want to incur a fine	Given that now we all contribute at least a little, I would like to exert more effort than I believe others do to show that I care more about the environment (Frey's crowding-in effect) <sup>b</sup>	-
Decrease	-	-	- Recycling (or not) should be an individual choice and not treated as an almost legal obligation (Frey's crowding-out effect)
			- I prefer to pay someone else to do my recycling (Public good crowding-out effect)

<sup>a</sup> *Positive Reciprocity.*

<sup>b</sup> *Strong Reciprocity.*

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<sup>58</sup> It has to be noted that this distinction has been made only for simplicity of exposition. 'Real' people are more complex and there might be situations somewhere in between that have not been considered in this taxonomy – e.g., people may care about the environment (*social man*), but might think that recycling does not contribute much to environmental conservation.

Table 3.3 and Table 3.4 show a behavioural taxonomy outlining all possible combinations of both men's reactions to external interventions (namely BIN and FINE in the tables). As shown in Table 3.3, feelings of pro-voluntarism and anti-state intervention translate into crowding-out intrinsic motivation of *social men*. Conversely, *economic men* who respond to enforcement and punishment are more likely to increase their contribution to recycling activities (see Table 3.4). These considerations may also play a role in determining respectively the crowding-in of *social men* contribution and the crowding-out of *economic men* intrinsic motivation.

However, it might be argued that, in this case, what matters more is the initial level of individuals' motivation. To give an example, a *social man* who affirms he/she would recycle at a voluntary base, but with medium effort, will probably not change his/her behaviour if recycling materials and services are improved, but he/she might increase his/her provision of effort because of feelings of anxiety and fear of receiving a fine. Similarly, an *economic man* who is reluctant to recycle on a voluntary base, showing low environmental morale, may react to a fair policy (such as the BIN scheme) by providing the same level of effort. However, feelings of anti-state intervention may crowd-out his/her intrinsic motivation, even when this is almost absent as, when facing the fine, he/she might dislike being forced to do things he/she does not like.

Finally, at the very extreme of this taxonomy there is an '*ardent*' *social man* and an '*ardent*' *economic man*. The former is a man who exhibits high environmental morale and therefore respond to external 'signals' by providing the same level of effort as before (i.e., always cares). By contrast, '*ardent*' *economic men* may react either by maintaining their (low) initial level of effort or by lowering their effort as incentives are provided. Whilst the taxonomies are detailed drawing on a number of distinctions, in the empirical study reported below it was possible to find some respondents in 16 of the possible 18 cases. This provides a measure of support for the validity of the distinctions made in the taxonomies (see Table 4.1).

**Table 3.3**

Social man and crowding-out effect

Are you a recycler? Yes = Social man									
Voluntary (Benchmark scenario/ Private Contribution)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bin (Facilitating Nudge/ State Intervention)	As before	As before	As before	More	More	More	Less Pro Voluntarism Anti-state intervention	Less Pro Voluntarism Anti-state intervention	Less Pro Voluntarism Anti-state intervention
Fine (Enforcing/ State intervention)	As before Ardent Social Man (Always cares)	More	Less Pro Voluntarism Anti-state intervention	As before	More	Less Pro Voluntarism Anti-state intervention	As before	More	Less Pro Voluntarism Anti-state intervention

**Table 3.4**

Economic man and crowding-in effect

	Are you a recycler? No = Economic man								
<b>Voluntary</b> (Benchmark scenario/ Private Contribution)	No	No	No	No	No	No	No	No	No
<b>Bin</b> (Facilitating Nudge/ State Intervention)	As before	As before	As before	More	More (Responds to enforcement)	More (Responds to enforcement)	Less	Less	Less
<b>Fine</b> (Enforcing/ State intervention)	As before Ardent Economic Man (Never cares)	More (Responds to punishment)	Less	As before	More (Responds to punishment)	Less	As before	More (Responds to punishment)	Less Ardent Economic Man (Never cares)

*Public good crowding-in/Frey's crowding-in*

### ***3.4.3 Independent variables***

In ‘SECTION 2’ and ‘SECTION 3’ of the questionnaire respondents were asked to provide information about their socio-demographic/economic background as well as their opinion on particular issues. Answers to these questions were used to model the independent variables (i.e., socio-demographic/economic variables, attitudinal variables and ethics) used in the regression analysis. Most of these variables were taken from the World Value Survey (WVS, 2009). However, here scales were modified and reduced (or increased) to a five point Likert scale to allow for consistency in the questionnaire and for the identification of a clear mid-point category. A detailed description of these variables along with the reasons for their inclusion in the survey is provided below.

#### ***3.4.3.1 Socio-demographic/economic variables***

*1- Gender* (dummy variable, 1=female). The role of gender has been evaluated in numerous studies in many areas of research, such as charitable donations, tax evasion and corruption. There has been a decrease in gender differences over the past few decades, and the opportunity cost argument in economics suggest that men and women should not necessarily show different motivations in making their decisions (see Torgler et al., 2008). However, many studies in the literature not only provide evidence that females are less selfish than males and more social-oriented (see e.g. Eckel and Grossman, 1998), but also show that women are more willing to be compliant and dislike cheating on taxes and/or accepting bribes<sup>59</sup>. How can this be related to recycling and more generally to environmental preferences? Henderson (1996 p. 148) provides a possible explanation for the differential importance of women in social context, suggesting that the reason why women spend their leisure time on social activities has to be found in their intrinsic “identities of nurturing, caring, passivity, gentleness...”. These characteristics make women more likely to be more likely to be concerned about the environment. In addition, their ‘traditional’ role of working at home predisposes them to be more involved in private contributions aimed at preserving the environment (see Torgler et al., 2008, 2009).

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<sup>59</sup> For the relationship between gender and tax evasion, see for example Schalteger and Torgler (2005), Torgler (2006), Lewis et al. (2009). For the relationship between gender and corruption see Dollar et al. (2001) and Frank et al. (2010).

Most of the available studies in the literature seem to confirm this tendency and show that pro-environmental behaviours are more common in females than males (e.g., Hines et al., 1987, and Whitmarsh and O'Neill, 2010). However, many studies attempting to evaluate households' determinants of recycling activities show that gender is not a fundamental determinant of recycling behaviours (see for example Domina and Koch, 2002, and Do Valle et al., 2004). Indeed, Barr (2003) shows that gender plays a major role for waste reduction rather than recycling behaviours and this trend might be due to the particular responsibilities females have in their house (such as doing shopping), where they might be more likely to make choices related to waste minimization.

2 – *Age* (ordinal variable, from 1 (15-24) to 5(55-64)). Instead of using a continuous variable, age has been classified in six categories. These include: 15-24, 25-34, 35-44, 45-54, 55-64, 65 and more years. As with gender effects, empirical findings on the relationship between age and recycling also seem to be controversial. Some studies show for example that older people are more likely to be engaged in recycling schemes than younger people (e.g., Ewing, 2001, and Barr, 2003). However, others show an insignificant or negative relationship between the two variables (see Werner and Makela, 1998, and Torgler et al., 2008). This might be due to two different reasons. On the one hand, as suggested by Oskamp et al. (1991), it might be expected that as soon as recycling becomes easier and accessible to all members of the society, the relationship between demographic variables and recycling is more likely to be weakened. On the other hand, according to Torgler et al. (2008) the controversy among age effects might be due to two different effects: one is a *life cycle* effect which is determined by being a member of a certain age group; one is a *cohort effect* resulting from being part of a specific generation. The former generally results into a negative correlation between age and the willingness to contribute to environmental protection given that older people are less likely to enjoy the long-term benefits of preserving the environment. The latter, by contrast, in addition to the idea that older people strongly depend on others' approval and/or reactions (Tittle, 1980), helps to explain why older people seem to be more compliant and might be more likely to contribute to pro-environmental behaviour.

3 – *Occupation* (set of dummy variables, 1 = reference category). Job position is generally considered as a complement for the economic situation of individuals. Hence, likewise the variables ‘income’ and ‘financial satisfaction’, occupation may also play a role in determining different individuals’ recycling attitudes. Unfortunately, there are not many studies in the literature that consider the role of occupation on recycling behaviour. Among the available analyses (e.g., Torgler and Garcia-Valiñas, 2007, and Torgler et al., 2008, 2009), some show that retired people seem to contribute less to the prevention of the environment, whereas part-time and full-time employees, and students seem to be more likely to contribute (e.g. Torgler, 2008)<sup>60</sup>. Some others (see Torgler et al., 2009), on the contrary, highlight that people on retirement have higher environmental morale than people with a different occupational status. Therefore it seems difficult to make predictions about the expected signs of estimated coefficient.

4 - *Marital Status* (set of dummy variables, 1 = reference category). A large body of empirical studies demonstrate the relevance of marital status as a determinant for individuals’ contribution to environmental quality (see e.g., Torgler et al., 2008, 2009) In general, awareness about environmental damages leads married people to comply more than single individuals as “they are more constrained by their social network and they are often very involved in the community” (Torgler et al., 2009, p. 15 ). Differences between married and single people have also been founded in their level of environmental morale and attitudes (see Torgler et al., 2009), with the former showing higher levels of environmental preference and morale. A possible explanation for this is given by the so called *parent effect*, which assumes married people as being more concerned about local environmental problems and their consequences on future generations (see Dupont, 2004). Drawing on this evidence, it is possible to expect a positive relationship between those who are married (or live as a couple) and their willingness to recycle. However, also in this case empirical evidence of recycling analyses seems to be inconclusive. Among those studies analysing the relationship between households’ type (e.g., single, couple, couple with one child, etc.) and recycling, some have found a significant relationship between the number of people living in the house and the frequency of recycling (see e.g. Gamba

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<sup>60</sup> These results are consistent with the *life cycle effect*, thus strengthening the argument that older people care less about environmental protection.



and Oskamp, 1994). Some others (see e.g. Werner and Makela, 1998, Torgler and Garcia-Valiñas, 2007) have found no relationship between the two variables. Thus the effect of marital status on recycling attitudes is difficult to predict and may lead to contradictory results.

*5 - Financial Satisfaction* (ordinal variable, from 1 = extremely dissatisfied to 10 = extremely satisfied). Respondents were asked to define, on a scale of 1 to 10, their financial satisfaction (where 10 is extremely satisfied, and 1 is extremely dissatisfied). Although the inclusion of an income variable is common practice among survey analyses, the reasons for its omission here are twofold: first, respondents might be sensitive to this kind of question, and secondly, different incomes may not be comparable across different countries. This said, there are reasons to believe that financial satisfaction is strongly related to income and represents therefore a good proxy for this variable. In fact, it can be argued that high income leads to a more comfortable life and more satisfaction, whereas low income tends to create a sense of dissatisfaction thus affecting negatively individuals' life style. Put differently, as income increases, people should be more willing to care and contribute to environmental prevention if this is considered as a normal good<sup>61</sup>. Nevertheless, also in this context there is not a general consensus about the effect of income on recycling. Some studies show a positive relationship between household with higher incomes and participation in recycling schemes (see Domina and Koch, 2002, and Torgler and Garcia-Valiñas, 2007). Some others do not find any significant relationship between the two variables (see, for example, Do Valle et al., 2004, and Whitmarsh and O'Neill, 2010).

*6 – Religion* (ordinal variable, from 1 = not at all important to 5 = very important). Respondents were asked to assess the importance of religion in their life. Options varied from 'very important' to 'not at all important' on a five-point Likert scale<sup>62</sup>. This variable has been extensively used in the tax evasion literature to evaluate how religion might influence tax morale (see Torgler, 2006). Indeed, it might be argued that religiosity influences beliefs about what is right or wrong in real life contexts. Torgler et al. (2008, 2009) analysing the differences in preference

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<sup>61</sup> This fact explains for example the existence of the so-called Kuznets curve.

<sup>62</sup> See WVS, section 'A. Perceptions of life'.

towards the environment found that churches can work as enforcement of social norms and that attendance to church is positively related to voluntary works<sup>63</sup>. Therefore there might be a positive relationship between environmental morale, individual' attitudes towards the environment and the importance of religion.

7 – *Nationality* (set of dummy variables, 1 = reference category). The variable comprises the following nationalities: British, Italian, Other European, African, American, Asian, Australian, Middle Eastern, and Pacific Islander. However, given the purposes of this study, the empirical analysis will be mainly focused on the differences between Italians and British.

8 – *Psychologists* (dummy variable, 1 = psychologist). Along the same lines, the analysis includes also a variable aimed at capturing the differences between psychologists and economists.

### **3.4.3.2 Attitudinal variables**

1 - *Risk Aversion* (dummy variable, 1 = risk averse). Respondents were required to rank (according to their relative importance) five different attributes about a job position. Those who put as their first or second choice “A safe job with no risk” were therefore considered as risk averse. As with other areas of research (see e.g. Torgler, 2006), this WVS question<sup>64</sup> is used here to infer individuals' risk aversity. To the best of the author's knowledge, this is the first survey in the field that considers the relationship between environmental morale, environmental contribution and risk propensity. Why might risk aversion play a role in this context? Recent studies in the literature suggest that, given the uncertainty of their intangible costs over time, environmental risks<sup>65</sup> represent a special category of risks (see Gattig and Hendrickx, 2007). Due to its characteristics, environmental risks are generally discounted less than other domains. How can this be related to environmental morale and attitudes? On the one hand, it might be argued that those who exhibit higher environmental

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<sup>63</sup> These works, however, infer importance of religion by asking respondents the following question: ‘Apart from weddings, funerals and christenings, how often do you attend religious services these days? (8 = More than once a week to 1 = practically never or never)’.

<sup>64</sup> See WVS, section ‘C. Work: first choice when looking for a job’.

<sup>65</sup> The term here is referred to negative consequences.

morale are generally more aware of environmental damages and therefore more willing to contribute to environmental quality (with respect to those who show a lower environmental morale). As suggested by Gattig and Hendrickx (2007, p. 22), individuals' "...support for policy measures depend on the extent to which they consider environmental problems...to be a risk". Thus, risk propensity might influence environmental morale and individuals' responses to different policies. Risk averse people might be therefore more compliant and, when an environmental risk is perceived as a loss, people will tend to avoid risk. However, on the other hand, if environmental risk constitutes a special kind of risk, being risk averse does not necessarily translate into being more willing to contribute given that other factors might play a role in determining individuals' decisions and behaviours (e.g., spatial and social distance of the negative outcomes)<sup>66</sup>. Therefore, it seems difficult to predict the effect of this variable on environmental morale and behaviour.

2 – *Trust in Government* (Ordinal variable, from 1 = none at all to 5 = a great deal). Individuals' political participation and trust in governments also seem to be key variables here. The present analysis infers trust in government by asking the respondents<sup>67</sup> what is the level of confidence they have in governments (5 = a great deal to 1 = none at all). Confidence in government seems to be a crucial factor when it comes to seeing how people react to variation of policy measures. Furthermore, trust in waste disposal authorities might increase cooperation especially among respondents with reciprocal preferences as 'most people build *trust* in and *networks* to others and come to *cooperate* with them' (Paldam, 2000, p. 629). Thus, trust in government might have a positive impact on individuals' contributions to environmental protection.

3- *Social responsibility* (continuous variable, sum score of selected items). As mentioned above, the literature suggests a positive relationship between being duty-oriented individuals and environmental morale and attitudes. The variable 'social responsibility' is employed here to test the direction of this relationship. However, rather than using a single question to infer individuals' social responsibility, the present analysis considers using a multi-item index. Despite the complexity

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<sup>66</sup> For a detailed discussion on these aspects see Gattig and Hendrickx (2007).

<sup>67</sup> See WVS, section 'E. Politics and Society'.

associated with the construction of this variable, it might be argued that social responsibility can be viewed as a multi-dimensional concept for which it seems more appropriate a multi-item measurement tool, as in psychometric analysis. Likewise individuals' 'moral values' or people's 'tax mentality' and/or 'tax morale', also individuals' social responsibility seems to be best captured by observing people's responses to a set of different questions rather than only to one question<sup>68</sup>. A multi-item index of social responsibility has, in fact, the advantage of being able to connect the interrelated facets of social responsibility and might reduce problems related to random errors in measurements, which are commonly present when using a single-item measure (see Alm and Torgler, 2006). Four questions (i.e., items) were used in order to analyse individuals' pro-social attitudes and to assess their social responsibility towards 'public' issues. The questions were chosen among those present in the 'justifiability section' of the WVS and more related to public injuries<sup>69</sup>. Respondents were thus required to state their opinions about justifiability of: cheating on taxes, throwing away litter in a public place, avoiding a fare on public transport, smoking in public place. To create the index, the degree to which respondents justified these statements was ranked from 1 (always justified) to 5 (never justified). The generated index was built by aggregating these values for each respondent, thus leading a range between 4 and 20. Internal consistency of the index was assessed using the Cronbach's (1951)  $\alpha$  psychometric test, which provided a moderate and acceptable (see Loewenthal, 1996) alpha-coefficient of reliability ( $\alpha = 0.57$ )<sup>70</sup>. This test statistic provides a measure of the correlation between the present scale and all other possible four-item scales measuring the latent variable 'environmental morale'. Full results are reported and discussed in Appendix 3C.

*4 – Altruism.* Respondents were asked to state how important is service to others in their life (5 = very important to 1 = not at all important). Answers to this WVS

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<sup>68</sup> In the tax evasion literature, Torgler and Schneider (2007) for example use the following questions to develop an index for individuals' moral values: justifiability of claiming government benefits to which they are not entitled, justifiability of avoiding a fare on public transport, and buying something knowing that it is stolen (1=never justifiable, 0=all other scales). Similarly, Kirchler (1997, 1999) uses different items to measure individuals' tax morale and tax mentality. He confronted individuals with various scenarios where a fictitious individual evaded and/or underreported income and they were asked to express their agreement/disagreement to them.

<sup>69</sup> See Section 'F. Religion and Morale' of the WVS.

<sup>70</sup> A preliminary investigation over the reliability of the index based on data from the WVS (2009) using the combined Italian and UK sample provides a Cronbach's  $\alpha$  of 0.61 (see Appendix 3C).

question<sup>71</sup> were therefore used as a proxy for individuals' altruism. The question captures the subjective importance of helping other people – i.e., the *warm glow* of giving. Carpenter and Myers (2010), for example, show that service to others (such as being a volunteer for the fire service) is positively related to altruism<sup>72</sup>. Similarly, Stern et al. (1995) and Corraliza and Berenguer (2000) suggest that altruistic people are more likely to take part to environmental activities. Finally, Ludemann (1999) find a positive relationship between altruistic motives for recycling and recycling. Therefore it might be predicted that altruism has a positive impact on environmental morale and attitudes to waste separation.

### 3.4.3.3 Ethics

*1 – Environmental morale* (continuous variable, sum score of selected items). A multi-item index was also created in order to infer individuals' environmental morale and to assess the direction of its relationship with recycling attitudes.

Previous studies in the literature (see e.g. Torgler et al., 2009) inferred environmental morale making use of the following WVS question:

'In the following statement, please tell me whether you think it is never justified, always justified or somewhere in between: ... to throw away litter in a public place', where available options were based on a ten-point Likert scale (1 = never justified, 10 = always justified).

Although it is common practice to use a single-item question to define more general concepts, there are several reasons why in the present analysis environmental morale has been derived by individuals' attitudes towards the environment. First, the question usually employed in the literature is a specific question about the justifiability of a particular behaviour towards the environment. However, one might argue that environmental morale needs to be defined in a more comprehensive

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<sup>71</sup> See WVS, section 'A. Perceptions of life'.

<sup>72</sup> However, in this case the proxy for the variable altruism is obtained from a dictator game experiment.

manner<sup>73</sup>. In other words, rather than inferring individuals' preferences towards the environment only using a single question, it could be useful to observe their preferences among different alternatives. This might help to shed light on how environmental morale drives individuals' behaviour when facing different opportunity costs in specific contexts. Second, as suggested by Torgler et al. (2009), when the WVS question is decontextualized from the more general set of the 'justifiability' questions, respondents might be biased to 'socially correct' answers. In other words, due to the nature of the question, individuals might be driven towards the answer 'never justified' as this seems the 'socially acceptable' answer. This poses the problem of systematic biases and of assessing reliability to the level of environmental morale inferred by the question. In other words, respondents will not state their real preferences but will tend to answer in the most 'politically correct' manner possible. This could also be exacerbated in a controlled environment such as the one used to conduct this survey. For the same reasons, a direct/specific question such as one asking

'Do you feel it is wrong or not wrong if a person does not contribute to the prevention of environmental degradation? (0 = not wrong, 1 = a bit wrong, 2 = wrong, 3 = seriously wrong)',

seems not to be feasible in this context. In addition, as the present analysis is based on a cross-country comparison, a question like this might also pose problems of interpretation. If values are formed in a particular country according to its own traditions and history, individuals will have, in fact, a different perception of what is right or wrong in specific countries. Therefore, in this context data comparison might be difficult.

Given these considerations, environmental morale was inferred using two different sets of questions regarding environmentally-friendly attitudes towards the environment. Previous research has also developed measures of pro-environmental self-identity using the same methodology (e.g., Berglund, 2006, Whitmarsh and

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<sup>73</sup> Torgler et al. (2009, p.8) also seem to allude to a broader definition of environmental morale as they define it (i.e., individuals' willingness to avoid littering the street) as "a particular case of environmental morale".

O'Neill, 2010). The index-items comprises: a question about individuals' willingness to buy a *green* product rather than a conventional identical good for which the price difference will help to protect the environment; and a question where individuals were asked to indicate how often they take specific actions (such as save water, recycle<sup>74</sup>, turn off light, and walk, cycle or take public transport)<sup>75</sup> for environmental reasons. The first question tries to infer individuals' willingness to sustain environmental protection through monetary contribution (i.e., a more explicit opportunity cost)<sup>76</sup>, whereas the second set of questions tries to capture their willingness to bear the time and trouble costs to contribute to a better environment (i.e., a more implicit opportunity cost).

Monetary contributions in the first question ranged between a minimum of 'zero' (i.e., only the same price as the conventional good) to a maximum of 'more than 30 per cent' (i.e., more than 30 per cent than the price of the conventional good). Each item in the second set of questions used instead a five-point Likert scale from 1 (never) to 5 (always). Despite these differences, a viable comparison between the item-answers was possible by assuming that those who were both willing to give a high monetary contribution (i.e., more than 30 per cent), and to provide 'always' pro-environmental behaviours exhibited very high environmental morale. Thus, as with the social responsibility index, after rescaling all item-answers with a common five-point Likert scale (where 5 = very high environmental morale, and 1 = very low environmental morale), a Cronbach's  $\alpha$  test was run to assess the reliability of the index ( $\alpha = 0.59$ ). This suggested removing the item assessing individuals' willingness to buy a *green* product from the index measurement (see Appendix 3C). All other items were therefore aggregated to form an index ranging from 4 to 20 ( $\alpha = 0.61$ ).

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<sup>74</sup> The inclusion of this item into the index measurement increases the reliability of the index (i.e., Cronbach's Alpha increases from 0.54 to 0.61). While it might appear circular to include this item, all of the tests reported below remain robust when this item is excluded from the index measurement.

<sup>75</sup> These actions are generally considered the most common *green* activities, i.e. water conservation, energy conservation, recycling, and traffic reduction (Whitmarsh and O'Neill, 2010).

<sup>76</sup> Monetary contributions have also been considered in other surveys to provide information about individuals' propensity to contribute to the environment. Torgler et al. (2008) analyse individuals' pro-environmental values asking respondents to provide their level of agreement/disagreement to the following WVS statements: 'I would give part of my income if I were certain that the money would be used to prevent environmental pollution', and 'I would agree to an increase in taxes if the extra money were used to prevent environmental pollution'.

The impact of socio-demographic/economic and attitudinal variables on recycling participation was then analysed using ordered probit and multinomial logit, since the dependent variables show respectively a natural and a non-natural order in their alternatives. This technique generates parameters providing information on respondents' likelihood to be involved in recycling activities. Probit regressions were also used in order to check the robustness of the results. A detailed description of these methodologies can be found in Verbeek (2008) and Long and Freese (2006), though they will be briefly illustrated in the following chapter along with regression results and discussion of policy implications.

### **3.5 CONCLUSIONS**

This chapter discusses the objectives of the present analysis and the methodology employed in order to test the hypotheses that: first, people react differently according to different government 'signals' (i.e., policies); secondly, individuals' reaction to external interventions differs according to respondents' level of environmental morale; and 3) thirdly, different degree choice and cultures may affect behaviour towards the environment.

The literature provides insights into the relevance of social norms as well as reciprocal and altruistic preferences in determining environmental morale and behaviour. Given that none of the available studies analyses the sign of the direction of this relationship, the present analysis also attempts to investigate this.

A seven-page questionnaire survey was developed in order to investigate the importance of these considerations in determining recycling behaviour and the crowding-out/in of individuals' intrinsic motivation and effort. The 'low cost' argument suggests, in fact, that a rich area of investigation to analyse the impact of policy interventions on individuals' intrinsic motivation is likely to be found in the private household sector. The questionnaire is divided into three different sections. The first section asks respondents to imagine themselves in hypothetical scenarios varying according to different policies. In particular, the analysis considers voluntary contributions to recycling activities (i.e. VOLUNTARY scenario) and 'induced'



contribution to recycling activities by means of an improvement of recycling services and (in addition to that with the use of) a fine (respectively the BIN and the FINE scenarios). The second and third sections were employed to evaluate how socio-demographic/economic variables and attitudinal variables influence recycling attitudes.

The impact of external regulations (VOLUNTARY *versus* BIN and FINE scenarios), the relationship between individuals' attitudes towards the environment and environmental morale, and the impact of social norms, reciprocal and altruistic preferences on environmental morale and behaviour are all discussed in the following chapter.

## **APPENDIX 3A: RECYCLING POLICIES IN ITALY AND UNITED KINGDOM**

EU policies have certainly played an important role in changing environmental attitudes of its Member States. Many EU Directives have been introduced to modify waste management practices in order to prevent environmental damage (e.g., greenhouse gas emissions, conservation of raw materials, and reduction of energy consumption), and to reduce and divert waste from landfill. In this context, the European Environment Agency (EEA, 2009) suggests that over time Italy and the United Kingdom have shown similar features regarding the diversion of municipal waste from landfill. According to the EEA's report (2009), they belong to those EU countries with high material recovery rates (> 25 per cent) and medium level of incineration (< 25 per cent) and dependence on landfill. Both countries also introduced policy instruments after the introduction of the Packaging Council Directive (94/62/EC)<sup>77</sup> and the Landfill Council Directive (99/31/EC)<sup>78</sup> by the EU.

Despite these considerations and the fact that the European Directives aimed at harmonizing the legislation within Member States, the flexibility of the EU's laws and the heterogeneity of Member State governments has fostered different policy measures to improve individuals' behaviour towards the environment either in countries with similar characteristics (e.g., UK and Italy) or even within countries (e.g., Italy). The United Kingdom, along with other new Member States<sup>79</sup> of the EU, made use of a 4-year derogation from the Landfill Directive and introduced the

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<sup>77</sup> The Packaging Directive was introduced by the European Union in order to prevent and manage packaging waste. The Directive set quantified targets for recycling and recovering packaging waste. The objective of the Directive was to push Member States to recycle between a minimum of 25 per cent to a maximum of 45 per cent of the total packaging materials within the 30 June of 2001, and to recycle between a minimum of 55 per cent to a maximum of 80 per cent of the total packaging materials within the end of 2008.

<sup>78</sup> The main objective of the Landfill Directive is to reduce and divert waste from landfill. This Directive has therefore important implication for waste management and disposal. Likewise the Directive 94/62/EC, the Landfill Directive imposed targets to Member States. According to them, EU's countries must reduce the amount of biodegradable municipal waste (BMW) going to landfill to 75 per cent, 50 per cent and 35 per cent of the 1995 level by 2006, 2009 and 2016, respectively.

<sup>79</sup> Greece, for example, had a 4-year derogation from both the Landfill Directive and the Packaging Directive.

Landfill Allowance Trading Scheme (LATS) only in 2005<sup>80</sup>. In contrast, Italy passed the Landfill Directive into national law in 2003 (despite the deadline expiring 18 months before). Other differences can also be found in the implementation of measures to reach the targets set by the EU and, as a consequence, in the results they have been able to attain (see Table 3A.1).

According to the latest available comparative figures (see European Commission, 2013), during the last decade both countries have considerably reduced the amount of waste diverted to landfill<sup>81</sup>. However, compared to the EU-27 (i.e., 36 per cent) they still overuse landfill. In 2008 Italy and the UK were also able to meet the target for recycling packaging waste (with 59.6 and 61.5 per cent of the total packaging materials respectively recycled), and they set new ambitious targets for the following two years<sup>82</sup>. The amount of waste incinerated shows an increasing trend even if in both countries the percentage of waste incinerated on total waste is generally below the EU-27 average percentage. However, when looking at municipal waste recycling<sup>83</sup> the differences between the two countries appear more clearly. Statistics provide evidence that overall recycling activities massively increased with respect to 2000, and in 2011 the percentage of material recycled, including other forms of recycling (i.e., composting and digestion), was doubled and quadrupled in size in Italy and UK respectively. Nevertheless, the data shows that the UK performed better in material recycling than Italy. Some 24.7 per cent of total waste generated in the UK was recycled in 2011, against 19.6 per cent recycled in Italy. In this regard, it might be argued that among other reasons, separate collection of waste (i.e., BMW and packaging) seems to play a major role (see for example EEA, 2009).

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<sup>80</sup> This option was offered to all Member States who landfilled more than 80 per cent of their municipal waste in 1995. Italy who was landfilling 82 per cent of its BMW waste, decided not to take advantages of the derogation.

<sup>81</sup> Compared with 2000 data, Italy has reduced the amount of waste dumped to landfill of about 36 per cent, while for UK the reduction amounts to 39 per cent.

<sup>82</sup> The new target for UK packaging recycling are 68.1 per cent in 2011 and 2012 (DEFRA, 2011), whilst for Italy they are 65.0 and 65.4 per cent in 2011 and 2012, respectively (CONAI, 2010).

<sup>83</sup> According to European commission, in addition to household waste, municipal waste includes waste generated by small businesses and public institutions that is collected by municipalities. According to the Classification of Economic Activities in the European Community (NACE - Division 37), recycling is only referred to the processing of used or unused materials, sorted or unsorted, which, after being treated, can be used by other sectors as an intermediate good. Therefore, recycling is not extended to the production of new final products and to re-used products (unless they require specific transformation processes).

**Table 3A.1: Waste management. A Comparison between EU-27, Italy and the UK**

Country	Years	TW	L	I	MR	OFR <sup>a</sup>	TR	RP <sup>b</sup>
EU-27	2000	522.0	55.2	15.1	14.9	9.4	24.3	N/A
	2001	520.0	53.5	15.6	15.8	9.6	25.4	N/A
	2002	526.0	51.1	16.2	18.1	10.1	28.1	N/A
	2003	514.0	49.6	16.3	18.9	10.5	29.4	N/A
	2004	513.0	46.6	17.3	19.3	11.3	30.6	N/A
	2005	515.0	42.9	18.4	20.2	11.7	31.8	54.6
	2006	521.0	42.0	19.0	20.7	12.1	32.8	56.9
	2007	522.0	40.8	19.2	22.0	12.3	34.3	59.2
	2008	519.0	38.3	19.7	22.9	13.7	36.6	60.5
	2009	509.0	37.7	21.2	24.2	13.9	38.1	62.5
	2010	505.0	37.2	21.8	24.6	13.5	38.0	63.3
	2011	500.0	36.0	22.2	24.6	14.0	38.6	N/A
Country	Years	TW	L	I	MR	OFR <sup>a</sup>	TR	RP <sup>b</sup>
ITALY	2000	509.0	75.6	7.7	10.0	4.3	14.3	38.4
	2001	516.0	67.6	8.5	12.0	5.8	17.8	45.5
	2002	522.0	63.2	9.0	9.2	5.7	14.9	51.4
	2003	521.0	59.9	10.6	10.4	6.0	16.3	51.4
	2004	535.0	57.0	11.2	11.2	6.4	17.6	53.3
	2005	540.0	54.4	12.0	11.7	6.9	18.5	53.7
	2006	552.0	53.8	12.7	11.8	7.4	19.2	54.9
	2007	548.0	52.0	12.4	12.4	8.0	20.4	56.8
	2008	543.0	49.5	12.7	14.2	9.4	23.6	59.6
	2009	533.0	48.4	14.4	18.8	10.9	29.6	64.0
	2010	537.0	46.2	16.6	19.7	12.1	31.8	64.4
	2011	535.0	46.4	16.4	19.6	11.8	31.4	N/A
Country	Years	TW	L	I	MR	OFR <sup>a</sup>	TR	RP <sup>b</sup>
UK	2000	577.0	81.1	7.3	8.3	2.8	11.1	39.9
	2001	591.0	80.0	7.3	9.1	3.2	12.4	42.4
	2002	599.0	77.5	7.5	10.5	4.0	14.5	44.2
	2003	592.0	74.2	7.6	13.3	4.7	18.1	46.8
	2004	603.0	69.3	8.0	15.6	7.0	22.6	49.7
	2005	583.0	64.3	8.4	18.2	8.6	26.8	54.4
	2006	586.0	60.1	9.2	20.0	10.2	30.2	57.5
	2007	570.0	56.7	9.3	22.1	11.6	33.7	59.3
	2008	544.0	52.8	10.3	23.3	13.2	36.6	61.5
	2009	526.0	49.2	11.6	27.0	14.6	41.6	61.8
	2010	521.0	48.9	11.5	24.8	14.0	38.8	60.7
	2011	518.0	48.8	11.6	24.7	14.1	38.8	N/A

<sup>a</sup> Other forms of recycling include composting and digestion. <sup>b</sup> Domestic recycling packaging (% on tot packaging waste).

**Notes:** Eurostat Statistics (European Commission, 2013). TW = Total Waste, L = Landfill, I = Incineration, MR = Material Recycling, OFR = Other Forms of Recycling (i.e., composting and digestion), TR = Total Recycling, and RP = Recycling Packaging. Total waste unit: kg per capita. All other statistics represent percentage on total waste.

Although Italy has continuously increased the amount of sorted and collected waste by types<sup>84</sup>, many improvements still need to be made. A recent report from the Institute of National Statistics (ISTAT, 2012) shows that in 2011 the proportion of sorted waste in the total amount of municipal waste was 33.4 per cent, representing an increase of 1.8 per cent over the previous year. Nevertheless, this figure is not encouraging given that Italy has not yet met the target agreed in 2006 (i.e., 35 per cent of waste recycled at source), and is a long way away from the one set in 2011 (i.e., 60 per cent of waste recycled at source). In addition, municipal waste fluctuations can make it even more difficult to meet the recent EU Waste Council Directive (2008/98/EC) target that requires EU's Member States to recycle, compost and reuse 50 per cent of household waste by 2020<sup>85</sup>.

By contrast, DEFRA's Statistical Release (DEFRA, 2012) reveals that on average total waste generation has been falling steadily since 2007/2008 by 2.6 per cent per year. Therefore it is not surprising that the proportion of material recycled, composted or reused between April 2011 and March 2012 reached 43 per cent, increasing by 3.4 per cent over the previous fiscal year. This is also strengthened by an additional reduction of produced waste per capita (that amounts to 431kg of waste per person).

The considerations above are exacerbated by the numerous differences between the performances of the various regions of Italy. The ISTAT's report (2012) shows that in 2011 in Northern Italy separate collection of municipal waste was higher than 40 per cent, with some municipalities meeting the 60 per cent target introduced by the national waste framework legislation (i.e., Legislative Decree 152/06). In Central Italy separate collection was around 30 per cent, whilst in the South of Italy it was only 19.5 per cent. Although all regions experienced a better performance over the previous year, these figures show that there is much to be done to homogenize and harmonize these areas to the national and international regulations. It might be argued that heterogeneity in the country is certainly due to the disaggregation of

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<sup>84</sup> A report from the Institute for Environmental Protection and Research (ISPRA, 2009) shows, for example, that the percentage of separate collection has increased from 22.7 in 2004 to 30.6 in 2009.

<sup>85</sup> According to ISTAT (2011), for example, after a decreasing trend registered in the past three years, in 2010 municipal waste per capita increased by 0.9 per cent compared to 2009.

responsibility between the different levels of governments (Central Government, Regions, Provinces and Municipalities), which makes it more difficult to secure the necessary cooperation and monitoring between various authorities.

Differences derive also from the disparate methods used in the two countries to divert waste from landfill not only with respect to other EU countries but also nationally. To give an example, landfill tax<sup>86</sup> rates in Italy range between 1 and 25 euros per tonne depending on the waste types (i.e., active or inactive waste). These tax rates are still much lower than other EU countries such as the UK where recent legislation (i.e., Landfill Tax Order, 2011) has raised the landfill tax rates from £40 to £48 per tonne, with an increase of £8 each year until 2014, with the aim of establishing a floor tax of £80 for the remaining 6 years (i.e., 2020)<sup>87</sup>. In addition, the Italian law allows regions to apply and enforce waste landfill tax rates. As a result, although the landfill tax was introduced in Italy by the Financial Act of 1996<sup>88</sup>, there are regions where it applied only in 2009 (e.g., in the Campania region).

Despite these considerations, in both countries recycling activities are still mainly based on voluntary contributions. Therefore, there is reason to believe that these differences are more likely to be related to late (or lack of) public acceptance of separate collection rather than to the financial constraints faced by the two countries. To the extent that lack of public acceptance might increase heterogeneity between (and within) countries and weaken policy measures that are positively regarded by the public (e.g., separate collection) (see EEA, 2009), understanding the interaction between government intervention and individuals' behaviour (and motivation) is of fundamental importance to the success of policy implementation.

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<sup>86</sup> The tax, paid by businesses and local authorities, is calculated by weight on total waste disposal at landfills or incineration plants without energy recovery.

<sup>87</sup> Law also provides a lower tax rate of 2.5 pounds per tonne for inactive waste.

<sup>88</sup> Law 549/1995.

## APPENDIX 3B: QUESTIONNAIRE

University of Bath  
Attitudes to Recycling

### Questionnaire

There are many reasons why governments are promoting recycling activities. In particular, they are aimed at reducing: waste to landfill; excessive consumption of raw materials; methane emissions; water contamination; and odours and noise pollution.

The purpose of this questionnaire is to gather information on people's attitudes towards recycling activities. The questionnaire is divided into three different sections. In 'SECTION 1' you are requested to answer questions about hypothetical scenarios regarding recycling activities. Each setting varies according to different policies introduced by the local authority, which is officially responsible for the provision of public services in your area. Remember these are imaginary situations that do not have to be necessarily related to your actual personal experience. In 'SECTION 2' and 'SECTION 3' you are asked to provide general information about yourself and to state your opinion on particular issues.

To answer the questions, please tick ONE of the boxes next to the answer(s); or, when appropriate, write your answer in the space provided. Unless the question allows you to tick more than one answer, please just tick one box per question.

I would be very grateful for your contribution to this study. All responses will remain anonymous. Thank you for your help.

#### SECTION 1: Hypothetical scenarios

**Q1 – Suppose you have to bear the time and trouble costs of recycling activities (i.e., separate your waste and bring it to the closest recycling centre; buy biodegradable garbage bags and different bins for specific waste; etc.). How would you define your level of contribution in terms of effort spent on recycling activities?**

Very high.....(Go to Q1.a below).....☐  
High.....(Go to Q1.a below).....☐  
Medium .....(Please select ONLY ONE option among the possible alternatives presented in Q1.a or Q1.b below to explain your position).....☐  
Low.....(Go to Q1.b below).....☐  
I will do hardly any recycling .....(Go to Q1.b below).....☐

**Q1.a – Please, indicate which of the following reasons was the most important for your decision:**

I believe environmental damages caused by not recycling are significant.....☐

I am well informed about waste recycling collection.....☐

I participate in recycling activities because others do so.....☐

Other reasons (**please write in**):

.....  
.....  
.....

**Q1.b – Please, indicate which of the following reasons was the most important for your decision:**

I believe environmental damages caused by not recycling are insignificant.....☐

I am not well informed about waste recycling collection.....☐

I do not participate in recycling activities because others do not.....☐

Other reasons (**please write in**):

.....  
.....  
.....

**Q2 - Suppose that in order to improve recycling activities the local authority decides to provide recycling materials (e.g. containers for waste and recyclables; liners; etc.) and to improve collection services (e.g. provision of convenient collection pavement points and/or increase the number of drop-off sites for recyclables; and for those with convenient collection points, increase the range of material collected; etc.). For this you will not be charged any fee.**

**Given your answer in QUESTION Q1, how do you think this will affect your behaviour?**

I would exert the same level of effort.....(**Go to Q3 below**).....☐

I would increase my effort.....(**Go to Q2.a below**).....☐

I would decrease my effort.....(**Go to Q2.b below**).....☐

**Q2.a – Please, indicate which of the following reasons was the most important for your decision:**

I am happy to spend more effort if recycling facilities increase.....☐

Recycling will be less time and effort consuming.....☐

I believe others will do so.....☐

Other reasons (**please write in**):

.....  
.....  
.....



**Q2.b - Please, indicate which of the following reasons was the most important for your decision:**

I would put in less effort because I can achieve the same quantity of recycling as before given the improved recycling activities.....☐

Recycling (or not) should be an individual choice and not treated as an almost moral obligation.....☐

I believe others will do so.....☐

Other reasons (**please write in**):

.....  
.....  
.....

**Q3 – Suppose now, in addition to the provision of recycling materials and the improvement of collection services, the local authority will introduce a money fine on those that do not recycle as requested. The money collected will be used to pay a company that manages to make use of the unsorted waste collected from your home. The environmental effect will be the same as if you did it by yourself. The money fine is set at the local littering fine if you are found to be not recycling.**

**Given your answer in QUESTION Q1, how do you think this will affect your behaviour?**

I would exert the same level of effort.....(**Go to Q4 below**).....☐

I would increase my effort.....(**Go to Q3.a below**).....☐

I would decrease my effort.....(**Go to Q3.b below**).....☐

**Q3.a - Please, indicate which of the following reasons was the most important for your decision:**

I will increase my efforts because I do not want to incur a fine.....☐

Given that now we all contribute at least a little, I would like to exert more effort than others to show that I care more about the environment.....☐

I believe others will do so.....☐

Other reasons (**please write in**):

.....  
.....  
.....

**Q3.b - Please, indicate which of the following reasons was the most important for your decision:**

I prefer to pay someone else for doing my recycling.....☐

Recycling (or not) should be an individual choice and not treated as an almost legal obligation.....☐

I believe others will do so.....☐

Other reasons (**please write in**):

.....  
.....  
.....

**SECTION 2: About you**

**Q4 – Gender:**

Male ..... ☐  
Female ..... ☐

**Q5 – Age:**

15 - 24 ..... ☐  
25 – 34 ..... ☐  
35 – 44 ..... ☐  
45 – 54 ..... ☐  
55 – 64 ..... ☐  
65 + years ..... ☐

**Q6 – Nationality:**

British ..... ☐  
Italian ..... ☐  
Other European ..... ☐  
African ..... ☐  
American ..... ☐  
Asian ..... ☐  
Australian ..... ☐  
Middle Eastern ..... ☐  
Pacific Islander ..... ☐

**Q7 - Marital status:**

Married ..... ☐  
Live as a couple ..... ☐  
Divorced ..... ☐  
Separated ..... ☐  
Widowed ..... ☐  
Single ..... ☐

**Q8 – On a scale of 1 to 10, how would you define your financial satisfaction?  
Where 10 is extremely satisfied and 1 is extremely dissatisfied.**

1	2	3	4	5	6	7	8	9	10
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**Q9 – Occupation:**

- Self – employed.....☐
- Part - time employed.....☐
- Full – time employed.....☐
- Unemployed.....☐
- At home.....☐
- Student.....☐
- Retired.....☐
- Other (Please state).....☐

**SECTION 3: General information**

**Q10 - Which of the following attributes would be most important for you about a job? Rank 1 to 5 each option below, with 1 = very important, 2 = important, 3 = moderately important, 4 = of little importance, 5 = unimportant.**

- A good income.....☐
- A safe job with no risk.....☐
- Working with people you like.....☐
- Doing an important job.....☐
- Doing something for community.....☐

**Q11 - How important is religion in your life?**

- Very important.....☐
- Important.....☐
- Rather important.....☐
- Not very important.....☐
- Not at all important.....☐

**Q12 – What is the level of confidence you have in governments?**

- A great deal.....☐
- Quite a lot.....☐
- A moderate amount.....☐
- Not very much.....☐
- None at all.....☐

**Q13 – How important is “service to others” in your life?**

- Very important.....☐
- Important.....☐
- Rather important.....☐
- Not very important.....☐
- Not at all important.....☐

**Q14 – How would you consider the following statements?**

a) Cheating on taxes:

- Never justified.....☐  
Rarely justified.....☐  
Sometimes justified.....☐  
Often justified.....☐  
Always justified.....☐

b) Throwing away litter in a public place:

- Never justified.....☐  
Rarely justified.....☐  
Sometimes justified.....☐  
Often justified.....☐  
Always justified.....☐

c) Avoiding a fare on public transport:

- Never justified.....☐  
Rarely justified.....☐  
Sometimes justified.....☐  
Often justified.....☐  
Always justified.....☐

d) Smoking in a public place:

- Never justified.....☐  
Rarely justified.....☐  
Sometimes justified.....☐  
Often justified.....☐  
Always justified.....☐

**Q15 - Suppose you have two identical ‘supermarket’ type goods: one is environmentally - friendly, the other one is a conventional product. Compared to the price of the conventional good, what price would you be willing to pay to buy the environmentally-friendly item? The difference in price helps to protect the environment.**

- Only the same price as the conventional good.....☐  
10 % more than the price of the conventional good.....☐  
20 % more than the price of the conventional good.....☐  
30 % more than the price of the conventional good.....☐  
More than 30% than the price of the conventional good.....☐

**Q16 - Please indicate how often you take each action for environmental reasons:**

a) Save water when taking a shower or brushing your teeth:

- Never.....☐  
Rarely.....☐  
Sometimes.....☐  
Often.....☐  
Always.....☐

b) Recycle:

- Never.....☐  
Rarely.....☐  
Sometimes.....☐  
Often.....☐  
Always.....☐

c) Turn off lights you are not using:

- Never.....☐  
Rarely.....☐  
Sometimes.....☐  
Often.....☐  
Always.....☐

d) Walk, cycle or take public transport:

- Never.....☐  
Rarely.....☐  
Sometimes.....☐  
Often.....☐  
Always.....☐

**Thank you for taking the time to complete this questionnaire!**

## APPENDIX 3C: CRONBACH'S ALPHA RESULTS

**Table 3C.1**

Cronbach's alpha: social responsibility – combined sample Italy and UK (WVS, 2009)

Variable	Mean	Standard Deviation	Observations	Corrected Item-Total Correlation <sup>a</sup>	$\alpha$ if Item Deleted <sup>b</sup>
F	2.32	2.00	2906	0.49	0.47
T	2.41	2.16	2906	0.33	0.59
L	1.88	1.60	2906	0.42	0.54
S	3.67	2.72	2906	0.38	0.57
$\alpha=0.61$ , Number of Items = 4, Mean = 10.27, SD = 5.85					

<sup>a</sup> The corrected Item-Total correlation shows how each item correlates with the others. Correlations <0.15 suggest excluding the item from the index.

<sup>b</sup> This column shows the Cronbach's  $\alpha$  when the item is deleted. Unless  $\alpha$  in this column is higher than that estimated for the total number of items, the item cannot be excluded from the analysis.

Notes: F = Avoiding a fare on public transport, T = Cheating on taxes, L = Throwing away litter in a public place, S = Smoking in a public place. Both the 'Corrected Item-Total Correlation' and the estimated ' $\alpha$  if Item Deleted' suggest that, with this data, no further improvements can be made to raise the  $\alpha$  coefficient.

**Table 3C.2**

Cronbach's alpha: social responsibility – combined sample Italy and UK (survey questionnaire)

Variable	Mean	Standard Deviation	Observations	Corrected Item-Total Correlation <sup>a</sup>	$\alpha$ if Item Deleted <sup>b</sup>
F	2.28	1.00	1165	0.37	0.48
T	1.89	0.95	1165	0.32	0.52
L	1.54	0.84	1165	0.41	0.46
S	2.10	1.20	1165	0.33	0.53
Cronbach's $\alpha=0.57$ , Number of Items = 4, Mean = 7.80, SD = 2.65					

<sup>a</sup> The corrected Item-Total correlation shows how each item correlates with the others. Correlations <0.15 suggest excluding the item from the index.

<sup>b</sup> This column shows the Cronbach's  $\alpha$  when the item is deleted. Unless  $\alpha$  in this column is higher than that estimated for the total number of items, the item cannot be excluded from the analysis.

Notes: F = Avoiding a fare on public transport, T = Cheating on taxes, L = Throwing away litter in a public place, S = Smoking in a public place. Both the 'Corrected Item-Total Correlation' and the estimated ' $\alpha$  if Item Deleted' suggest that, with this data, no further improvements can be made to raise the  $\alpha$  coefficient.

**Table 3C.3**

Cronbach's alpha: environmental morale (5 items) – combined sample Italy and UK (survey questionnaire)

Variable	Mean	Standard Deviation	Observations	Corrected Item-Total Correlation <sup>a</sup>	$\alpha$ if Item Deleted <sup>b</sup>
GP	2.12	0.86	1165	0.18	0.61
SW	3.29	1.14	1165	0.46	0.47
R	3.81	1.06	1165	0.34	0.54
SE	4.10	0.94	1165	0.40	0.51
PT	2.95	1.29	1165	0.37	0.53
Cronbach's $\alpha$ = 0.59, Number of Items = 5, Mean = 16.27, SD = 3.29					

<sup>a</sup> The corrected Item-Total correlation shows how each item correlates with the others. Correlations <0.15 suggest excluding the item from the index.

<sup>b</sup> This column shows the Cronbach's  $\alpha$  when the item is deleted. Unless  $\alpha$  in this column is higher than that estimated for the total number of items, the item cannot be excluded from the analysis.

Notes: GP = Green Product, SW = Safe Water, R = Recycling, SE = Save Energy, PT = Public Transport. The estimated ' $\alpha$  if Item Deleted' suggests removing the item 'GP' to improve the reliability of the index of environmental morale (i.e.,  $\alpha$  increases from 0.59 to 0.61).

**Table 3C.4**

Cronbach's alpha: environmental morale (4 items) – combined sample Italy and UK (survey questionnaire)

Variable	Mean	Standard Deviation	Observations	Corrected Item-Total Correlation <sup>a</sup>	$\alpha$ if Item Deleted <sup>b</sup>
W	3.29	1.14	1165	0.46	0.48
R	3.81	1.06	1165	0.34	0.57
S	4.10	0.94	1165	0.43	0.52
T	2.95	1.29	1165	0.35	0.58
Cronbach's $\alpha$ = 0.61, Number of Items = 4, Mean = 14.16, SD = 3.03					

<sup>a</sup> The corrected Item-Total correlation shows how each item correlates with the others. Correlations <0.15 suggest excluding the item from the index.

<sup>b</sup> This column shows the Cronbach's  $\alpha$  when the item is deleted. Unless  $\alpha$  in this column is higher than that estimated for the total number of items, the item cannot be excluded from the analysis.

Notes: GP = Green Product, SW = Safe Water, R = Recycling, SE = Save Energy, PT = Public Transport. Both the Corrected Item-Total Correlation and the estimated ' $\alpha$  if Item Deleted' suggest that removing any items would not lead to further improvements of the  $\alpha$  coefficient.

## **Chapter 4**

# **ECONOMIC INCENTIVES AND ENVIRONMENTAL MORALE: AN EMPIRICAL INVESTIGATION OF RECYCLING**

### *Data analysis and discussion of results*

#### **4.1 INTRODUCTION**

The survey described in chapter 3 provides a unique opportunity to examine the impact of different policy measures on individuals' motivation to contribute to recycling and might help to shed light on the determinants of environmental morale as the intrinsic motivation to behave in a more conscious way in environmental contexts. Data collected in this survey might serve as a complement to previous analyses conducted in the laboratory and/or using survey methods to demonstrate the existence of the crowding-out effect of intrinsic motivation in environmental contexts and to provide a contribution to understand what shapes environmental morale.

The chapter is organized as follows. The next section provides a general description of the survey data. It is followed by a detailed presentation of empirical results in section 4.3. The chapter concludes with overall remarks and a discussion of possible policy implications of the empirical results.

#### **4.2 DESCRIPTION OF THE DATA**

The responses to the different scenarios are reported in Table 4.1 which is informed by the taxonomies detailed in Tables 3.2 and 3.3 above. The table shows answers to the VOLUNTARY, BIN and FINE hypothetical scenarios for the full sample. In the table, social men are those who were willing to contribute at least at a 'medium' level to recycling activities, while economic men are those who were willing to



provide low, or no effort for recycling in the VOLUNTARY scenario. Responses reported in the table are conditioned on those provided in the benchmark setting. This allows a viable comparison across scenarios in terms of private contribution to recycling activities and offers a possible interpretation of individuals' reaction to different policy measures.

Table 4.1 highlights that in general attitudes were 'friendly' to recycling activities as the majority of respondents (i.e., 82%) declared they would voluntarily contribute to recycling at least at a medium level. However, there is also a reasonable fraction of respondents that seems to be reluctant to recycle when this has to be done on a voluntary basis (i.e., 18%).

Results provide evidence of a strong crowding-in effect of effort among individuals' attitudes. A large body of respondents (44% and 73% of social and economic men, respectively), stated, in fact, they would increase their provision of effort both with the policy improvement and with the introduction of the fine, or alternatively when one of the two policies was considered. However, there are also a significant proportion of respondents that declared they would decrease their effort, providing support for the existence of a crowding-out effect.

In line with results obtained by Feldman and Perez (*forthcoming*), a considerable number of respondents seem to be resistant to the mandatory scheme. According to this survey, the effect was predominant among economic men. Indeed, about 8% of respondents (against 3% among social men) demonstrated resentment to the enforcing state intervention. By contrast, social men reacted more actively to the introduction of the fine. Some of 18% of respondents (vs. 6% among economic men) stated in fact they would maintain/decrease their initial level of effort with the improvement of facilities, whereas they would increase their provision of effort with a fine imposed on those who are not recycling.

**Table 4.1**Social Man *versus* Economic Man

<b>Are you a recycler? Yes = Social Man</b>									
Voluntary scenario	yes	yes	yes	Yes	yes	yes	yes	yes	yes
Bin Scenario	as before	as before	as before	More	more	more	less	less	less
Fine Scenario	as before	more	less	as before	more	less	as before	more	less
N. obs.	159	139	7	176	421	10	12	36	5
% on Tot.	16%	14%	1%	18%	44%	1%	1%	4%	1%
<b>Are you a recycler? No = Economic Man</b>									
Voluntary scenario	No	No	No	No	No	No	No	No	No
Bin Scenario	as before	as before	as before	More	more	more	less	less	less
Fine Scenario	as before	more	less	as before	more	less	as before	more	less
N. obs.	7	12	1	22	145	10	0	0	3
% on Tot.	4%	6%	1%	11%	73%	5%	0%	0%	2%

*Notes:* Proportion of responses of social men (965 observations) and economic men (200 observations). The table reports different responses to the VOLUNTARY, BIN, and FINE hypothetical scenarios for the full sample. Percentages are calculated on the total number of social and economic men.

A possible explanation for this lies on the idea that individuals might be either indifferent to the policy improvement given their high contribution or resistant to it if this is perceived as controlling (i.e., moral obligation imposed by the Government), but, at the same time, they can be more willing to cooperate when state intervention (such as a mandatory scheme) is regarded as a sort of assurance against free riders (see also Feldman and Perez, *forthcoming*).

Table 4.1 seems to indicate that people react to different policies in different ways. However, from the table it is not possible to capture the linkage between respondents' reactions to policy change and environmental morale, or to discern the motivation (Frey, 1997) from the public good crowding-out/in effect (see Andreoni, 1989, 1990). Therefore, Table 4.2 reports the proportion of responses to the three hypothetical scenarios depending on individuals' level of environmental morale, whereas responses to the follow up questions described in chapter 3 (see Table 3.2) are reported in Table 4.3.

In Table 4.2, for simplicity, the index of environmental morale was grouped in three different categories, showing low (index score < 12), medium (index score = 12) and high level of environmental morale (index score > 12)<sup>89</sup>. The Pearson chi-square ( $\chi^2$ ) test was used here to assess the mutual independence of individuals' reactions on their level of environmental morale. This tests the null hypothesis that the occurrence of two paired observations on two categorized variables (i.e., two cells in a contingency or cross-tabulated table) is independent of one another. The test statistic (which approaches asymptotically a  $\chi^2$  distribution) is given by the sum of the ratio between the squared differences of observed and expected frequencies (asserted by the null hypothesis)<sup>90</sup> and the expected frequencies in each cell of the table. Independence is assessed by comparing the calculated  $\chi^2$  to the critical value

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<sup>89</sup> Using a five-point Likert scale (see Chapter 3), the mid-point category is identified by aggregating the mid-point category (i.e., 3 = sometimes) of each single item, which leads to a total of 12. However, all tests remain robust even when considering separated levels of environmental morale.

<sup>90</sup> In other words, expected frequencies are obtained assuming that the two variables (here, different levels of environmental morale and individuals' responses to policy change) were independent. In contingency tables, this translates into computing the expected frequencies by multiplying together the totals for the row and column of each cell and dividing by the total sample size. For a detailed discussion about the Pearson chi-square test, see e.g. Howell (2013).

from the chi-square distribution, which is obtained using the relevant degrees of freedom<sup>91</sup>.

**Table 4.2**

Proportion of responses according to individuals' level of environmental morale

VOLUNTARY scenario				
	Low	Medium	High	No. Obs.
Low	41.83%	20.43%	10.88%	17.17%
Medium	34.13%	46.24%	42.01%	40.94%
High	24.04%	33.33%	47.10%	41.89%
No. Obs.	17.85%	7.98%	74.16%	100.00%
%	100.00%	100.00%	100.00%	100.00%
Pearson $\chi^2$ (8) = 134.88 , p-value = 0.00 <sup>a</sup>				
BIN scenario				
	Low	Medium	High	No. Obs.
Same effort	19.71%	26.88%	29.98%	27.90%
Increase effort	72.60%	65.59%	66.20%	67.20%
Decrease effort	7.69%	7.53%	3.82%	4.81%
No. Obs.	17.85%	7.98%	74.16%	100.00%
Pearson $\chi^2$ (4) = 14.21 , p-value = 0.00 <sup>b</sup>				
FINE scenario				
	Low	Medium	High	No. Obs.
Same effort	20.67%	33.33%	34.95%	32.27%
Increase effort	72.60%	64.52%	62.73%	64.64%
Decrease effort	6.73%	2.15%	2.31%	3.09%
No. Obs.	17.85%	7.98%	74.16%	100.00%
Pearson $\chi^2$ (4) = 24.02 , p-value = 0.00 <sup>c</sup>				

<sup>a</sup> 0 cells (0.0%) have expected count less than 5. The minimum expected count is 15.97.

<sup>b</sup> 1 cells (11.1%) have expected count less than 5. The minimum expected count is 4.47.

<sup>c</sup> 1 cells (11.1%) have expected count less than 5. The minimum expected count is 2.87.

Notes: For simplicity responses to the VOLUNTARY scenario were grouped as follows: Low = Low/I will do hardly any recycling; Medium = Medium; and High = High/Very high.

As shown in Table 4.2 there is a substantial and significant difference (Pearson's  $\chi^2_{(8)} = 134.88$ ,  $p\text{-value} < 0.01$ ) between those who exhibit high environmental morale and those with low environmental morale in their willingness to voluntarily contribute to recycling, with those with high environmental morale contributing

<sup>91</sup> One of the main assumptions of the Pearson's chi-squared test is the independence of observations. Given that a question about recycling is included into the computation of the index of environmental morale, one might argue that this can question the assumption of independence. However, all tests and regressions included in this chapter remained robust even when excluding the recycling scores from the index of environmental morale. Therefore, to improve the reliability of the index (see Cronbach's alpha test in Chapter 3), it was decided to leave this item into the index measurement.

more<sup>92</sup>. According to the table, there is also evidence of a significant difference between individuals' reaction to policy measures depending on individuals' environmental morale (Pearson's  $\chi^2$  has  $p$ -value  $< 0.01$  in both scenarios)<sup>93</sup>.

In general, respondents seem to be willing to increase their provision of effort both with the policy improvement and with the introduction of the fine, regardless of their level of environmental morale. However, the effect is moderately stronger among those who exhibit low environmental morale. Indeed, in both scenarios, about 72.60% of respondents with low environmental morale declared they would increase their provision of effort. A detailed analysis of the data shows (results not reported here) that this trend rapidly grows when approaching a medium level of environmental morale (i.e., 12), but slows down with higher levels of environmental morale (i.e., when the index ranges between 16 and 20). In contrast, those who are located at the very extremes of the index-scale of environmental morale were less likely to respond to policy changes – i.e., they were either deflected from their current behaviour or neutral. The tables suggest in fact that there are a substantial proportion of respondents who exhibited high/low environmental morale that were either willing to decrease their provision of efforts (3.83% and 7.69% of respondents vs. 2.31% and 6.73% of respondents, respectively in the BIN and FINE scenario) or indifferent to policy changes (20.67% and 34.95% of respondents vs. 29.98% and 19.71% of respondents, respectively in the FINE and BIN scenarios).

In order to capture the reasons for individuals' reactions, Table 4.3 reports the proportion of responses to the follow-up questions. In line with previous findings (e.g., Barr, 2003), awareness and lack of information represent crucial factors for individuals' willingness/unwillingness to voluntarily contribute to recycling. It is interesting to note that, in this context, a large body of respondents (43%) chose the option 'Other reasons'. Figure 4.1 below reports answers provided by respondents in

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<sup>92</sup> It is worth noting that, in addition to recycling, the index of environmental morale is inferred using individuals' willingness to contribute to other 'green' activities. On the one hand, this explains why some of the respondents with low environmental morale are also willing to recycle. On the other hand, this justifies why some respondents who exhibit medium and high environmental morale seems to be reluctant to contribute to recycling activities.

<sup>93</sup> As a general rule of thumb, the Pearson chi-squared test is reliable when no more than 20% of the cells have expected count less than 5 (see Blalock, 1979, and Howell, 2002), and/or the minimum expected frequency is higher than 5.

these circumstances. Although part of the respondents attributed their low disposition to contribute to recycling to carelessness or laziness (28%), the majority of them stated they would do so because of the time and trouble costs of recycling (55%). This result provides further evidence for the observation that recycling represents a social cost and strengthens the idea that such costs should be taken into account in cost-benefit analyses of different policy measures (see e.g. Bruvoll et al., 2002, Berglund, 2006, and Nyborg, 2008).

Looking at the other two hypothetical scenarios, in the BIN scenario instrumental behaviour seems to be predominant (see Table 4.3). However, data also show that the quality improvement led some respondents with *positive* reciprocal preferences (37%) to respond in kind, and some others who perceived the policy as *controlling* (i.e., by imposing a moral obligation on recyclers) to state they would reduce their provision of effort with the policy (30%).

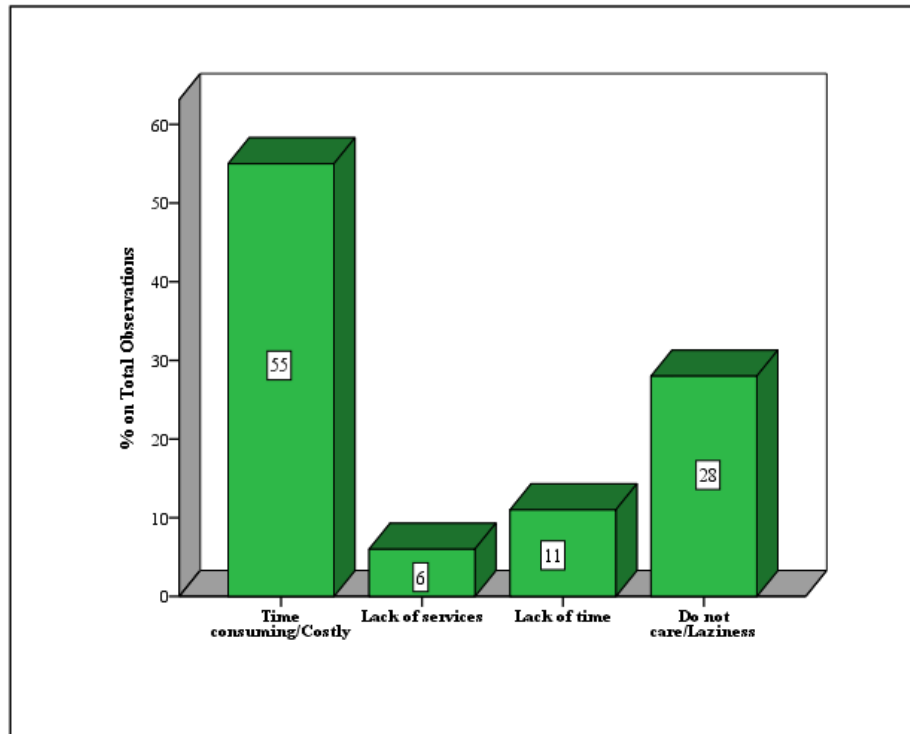
**Table 4.3**  
Individual attitudes towards recycling and policy measures

Medium/High Voluntary Contribution		Low (Medium) Voluntary Contribution <sup>a</sup>	
<i>Answers</i>		<i>Answers</i>	
Awareness	74%	Lack of awareness	12%(18%)
Information	16%	Lack of information	32% (55%)
Conform to norms	9%	Conform to norms	13% (12%)
Other Reasons	1%	Other Reasons	43% (15%)
<i>N. obs.</i>	869	<i>N. obs.</i>	200 (96)
Increase effort in BIN scenario		Deacrese effort in BIN scenario	
<i>Answers</i>		<i>Answers</i>	
Crowding-in effect	37%	Public good crowding-out	70%
Disciplining effect	61%	Frey's crowding-out	30%
Conform to norms	2%	Conform to norms	0%
Other reasons	0%	Other Reasons	0%
<i>N. obs.</i>	784	<i>N. obs.</i>	56
Increase effort in FINE scenario		Decrease effort in FINE scenario	
<i>Answers</i>		<i>Answers</i>	
Crowding-in effect	19%	Public good crowding-out	19%
Disciplining effect	78%	Frey's crowding-out	81%
Conform to norms	3%	Conform to norms	0%
Other reasons	0%	Other reasons	0%
<i>N. obs.</i>	753	<i>N. obs.</i>	36

<sup>a</sup> Percentage of answers of those who declared they would provide a medium level of effort in the VOLUNTARY scenario is reported in parentheses.

Notes: The proportion of responses of each follow-up question is calculated according to the total number of observation related to each scenario. The table is built using full sample responses.

**Figure 4.1:** Distribution of ‘Other reasons’ answers



*Notes:* The figure reports percentage responses to ‘Other reasons’ to the question Q1.b of the questionnaire (see Chapter 3, Appendix 3B). Percentages are calculated on the total number of individuals that chose the option ‘Other reasons’, i.e. 99 students.

In the FINE scenario there is evidence of both a disciplining and a crowding-out effect, working in an opposite direction (see Table 4.3). In line with previous analyses (see for example Gneeze and Rustichini, 2000b, Fehr and Gächter, 2002, and Falk and Kosfeld, 2006) the crowding-out effect of intrinsic motivation seems to be stronger than the disciplining effect (81% vs. 78%, respectively). Results also indicate that a reasonable proportion of respondents (19%) exhibited *strong* reciprocal preference, thus confirming the hypothesis that external interventions may crowd-in intrinsic motivation of conditional co-operators. Finally, it is interesting to note that, among those individuals that stated they would decrease their effort because of the introduction of a fine, Frey’s crowding-out effect (81%) was predominant with respect to public good crowding-out effect (19%).

In summary, given that the crowding-in effect of intrinsic motivation was stronger in the BIN scenario than in the FINE scenario and the crowding-out effect of intrinsic motivation dominated in the FINE scenario compared to the BIN

scenario, it is possible to conclude that respondents perceived the facilitating *nudge* policy measure as more desirable than the mandatory scheme<sup>94</sup>.

## 4.3 EMPIRICAL RESULTS

### 4.3.1 Methodology

The impact of socio-demographic/economic, attitudinal variables and ethics on the willingness to contribute to recycling activities under different policy schemes was analysed using ordered probit and multinomial logit regressions since, as stated in the previous chapter, the nature of the dependent variables show respectively an ordered nature in the VOLUNTARY scenario and a non-natural ordering in the BIN and FINE scenarios.

To model the willingness to contribute to recycling activities in the VOLUNTARY scenario it was assumed that the outcomes  $y_i$  took values  $y_i = 1$  (I will do hardly any recycling),  $y_i = 2$  (low contribution),  $y_i = 3$  (medium contribution),  $y_i = 4$  (high contribution) and  $y_i = 5$  (very high contribution). Ordered response models are based on one underlying latent variable,  $y_i^*$ , that consider a different match from the latent variable,  $y_i^*$ , to the observed one (i.e.  $y_i = 1, 2, 3, 4, 5$ ). Thus, assuming a vector of exogenous variables  $x_i'\beta$  (where  $\beta$  is a vector of unknown parameters)<sup>95</sup>, the relationship between  $x_i'\beta$  and  $y_i^*$  can be written as follows (see Verbeek, 2008)<sup>96</sup>:

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<sup>94</sup> It could be argued that the receipt of the bins might have changed respondents' perception of real income positively thereby inducing them to be more willing to increase their provision of effort and motivation. However, given the hypothetical nature of the questions and the interventions, there is reason to believe that this effect is negligible here.

<sup>95</sup> The symbol ' $'$ ' denotes the *transpose* of the  $k$ -dimensional vector  $x_i$  containing the characteristics of individual  $i$  (including an intercept term).

<sup>96</sup> This model assumes that the standard deviation is equal to one, i.e.,  $\sigma = 1$ , and the intercept is equal to zero (i.e.,  $\beta_1 = 0$ ) to circumvent the problem of identification (as estimation results are obtained with Stata).



$$y_i^* = x_i' \beta + \varepsilon_i, \quad (4.1)$$

$$y_i = \begin{cases} 1 & \text{if } y_i^* < \gamma_1 \\ 2 & \text{if } \gamma_1 \leq y_i^* < \gamma_2 \\ \vdots & \vdots \\ j & \text{if } y_i^* \geq \gamma_{j-1} \end{cases}, \quad (4.2)$$

where  $\varepsilon_i$  is an unobserved error term, independent on  $x_i$  and normally distributed with mean equal to zero and variance equal to  $\sigma^2$  (i.e.,  $\varepsilon_i$  is  $NID(0, \sigma^2)$ )<sup>97</sup>,  $\gamma_j$ s are unknown parameters<sup>98</sup> that are estimated jointly with  $\beta$ ,  $j = 1, 2, 3, 4, 5$  and  $i = 1, \dots, n$  (i.e., represents individual observations in the sample). Therefore the probability of choosing  $j$  is equal to the probability that the latent variable  $y_i^*$  ranges between the boundaries  $\gamma_{j-1}$  and  $\gamma_j$ <sup>99</sup>.

In general, the probability of observing a particular outcome is expressed by:

$$P\{y_i = j | x_i\} = \phi(\gamma_j - x_i' \beta) - \phi(\gamma_{j-1} - x_i' \beta), \quad (4.3)$$

where  $\phi$  represents the standard normal cumulative distribution function (CDF). However, when  $j$  is equal to the highest outcome, the generic form reduces to:

$$P\{y_i = \varphi | x_i\} = \phi(\gamma_\varphi - x_i' \beta) - \phi(\gamma_{\varphi-1} - x_i' \beta) = 1 - \phi(\gamma_{\varphi-1} - x_i' \beta), \quad (4.4)$$

where  $\varphi$  represents the highest category among the available outcomes.

This estimation technique is based upon maximum likelihood, where the described probabilities enter the likelihood function. Generated parameters provide information on respondents' willingness to contribute to recycling activities and can

<sup>97</sup> The acronym stays for 'normally and identically distributed'.

<sup>98</sup> These are generally known as *cutpoints* or *threshold* parameters.

<sup>99</sup> The standard model assumes that  $\gamma_0 = -\infty$ , and  $\gamma_{j \rightarrow \infty} = \infty$ .

be interpreted either in terms of the effect generated on the underlying latent variable (i.e., a positive value of  $\beta$  increases the willingness to contribute to recycling) or in terms of the effects generated on the respective probabilities (i.e., a positive value of  $\beta$  means that the probability that  $y_i=5$  will increase, while the probability that  $y_i=1$  will decrease). However, in the second case the effect on intermediate categories is ambiguous (i.e., the probability that  $y_i=2,3,4$  may increase or decrease). Therefore in order to capture the impact of the estimated parameters on the latent variable marginal effects need to be computed. Marginal effects are defined as the partial derivatives of the probability that  $y_i$  equals a specific  $j$ -th outcome with respect to a specific explanatory variable  $x_{ik}$  and can be obtained as follows:

$$\delta_{ik} = \left( \frac{\partial P(y_i = j | x_i)}{\partial x_{ik}} \right) = [\phi(\gamma_{j-1} - x_i' \beta) - \phi(\gamma_j - x_i' \beta)] \beta_k, \quad (4.5)$$

where  $\delta_{ik}$  represents the marginal effect,  $\phi$  is the standard normal cumulative distribution function and  $\beta_k$  is the  $k$ -th estimated coefficient of  $x_{ik}$ . Note that when  $j=1, 2$  the model reduces to the standard binary probit<sup>100</sup>.

To model the willingness to increase/decrease or provide the same level of effort in the BIN and FINE scenarios a multinomial logit model was also employed. Alternatives provided in both scenarios, in fact, could not be rescaled in an ordered way. Therefore, the options were indexed as follows:  $y_i=1$  for the alternative ‘I would exert the same level of effort’,  $y_i=2$  for ‘I would increase my effort’, and  $y_i=3$  for ‘I would decrease my effort’. This model is based on the assumption that the alternative chosen provides the highest level of utility. Utilities provided by each alternative are assumed to be linearly related to a vector of explanatory variables  $x_i' \beta$  (where  $\beta$  is a vector of unknown parameters to be estimated in the model and

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<sup>100</sup> Binary probit regression analyses were employed in order to check the robustness of the results using appropriate recoding of the alternatives as will be explained further below.

the vector  $x_i$  includes an intercept term) and to an error term  $\varepsilon_i$ . As with the ordered probit, multinomial logit models are estimated by maximum likelihood (where the probabilities of the observed outcomes enter the loglikelihood function) and represent a generalization of a logistic regression model where more than two options can be considered. Therefore, making specific assumptions on the distribution of the disturbances, the relationship between  $x_i'\beta$  and the probability of observing a particular outcome  $y_i = j$  rather than an alternative one can be written as (see Verbeek, 2008):

$$\log \frac{p_{ij}}{p_{iJ}} = \exp(x_{ij}'\beta), \quad (4.6)$$

where the left-hand side part of equation (4.6) represents the log odds ratio,  $p_{ij} = P\{y_i = j|x_i\}$  and  $p_{iJ} = P\{y_i = J|x_i\}$  are respectively the probabilities of observing outcome  $j$  and  $J$ , and  $j = 1, 2, \dots, J-1$ . The main difference with a binary logit model is that the single logistic regression equation contrasts the probability of one outcome (e.g., successes) against that of another outcome (e.g., failures). By contrast, the multinomial logit model compares each of the categories  $j = 1, 2, \dots, J-1$  with category  $J$ . The latter is usually defined as the base category (outcome 1 in this analysis)<sup>101</sup> and it is commonly represented by the denominator of equation (4.6). Therefore, the estimated  $\beta$  coefficients can be interpreted in terms of the effect generated upon the log odds ratio. *Ceteris paribus*, a positive  $\beta_k$  coefficient means that a unit increase of  $x_{ik}$  is associated with an increase (measured by the estimated coefficient) of the log odds ratio of being in category  $j$  rather than in the base category. Marginal effects can also be used in order to obtain information about the change in probability for an event to occur when one of the dependent variable change by one unit, holding all the other variables constant.

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<sup>101</sup> There is no difference in the results in the choice of the reference category. By default Stata chooses the category with the highest number of responses. However, in this analysis the reference category is represented by outcome 1 (i.e., 'I would exert the same level of effort') to make a viable comparison with the willingness to change the level of effort with the introduction of different policies.

According to the methodologies above described the following relationship was estimated:

$$dep_i = \beta_0 + \beta_1 sociodem_i + \beta_2 attitudes_i + \beta_3 ethics_i + \varepsilon_i, \quad (4.7)$$

where  $dep_i$  represents the dependent variables (i.e. VOLUNTARY, BIN and FINE scenarios). A description of the variables included in the analysis with their summary statistics and expected sign are reported in Appendix 4A<sup>102</sup>.

#### 4.3.2 Regression results

Before proceeding with the discussion of the results two issues are worth emphasizing when focussing on the validity of the data. First, in order to circumvent cognitive problems (see for example Torgler et al., 2009) related to manipulations in ordering questions or changing the wording scale, the correlation between two similar questions asked at the beginning and at the end of the survey was explored. In particular, the answers provided in the VOLUNTARY scenario (VOL) were compared to those provided in question Q16 (part b) of the questionnaire described in chapter 3, where respondents were required to state their actual behaviour towards recycling activities (REC). The correlation between the VOL and the REC is 0.39 ( $p < 0.01$ ). The fact that the variables are highly correlated although the order of responses was reversed seems to reduce problems related to *framing biases*. Note that the survey was conducted in a controlled environment, which might help to guarantee that subjects paid attention to the whole list of alternative responses.

Second, the survey seems not to suffer of problems related to ‘socially acceptable’ answers as the majority of respondents did not provide the more ‘socially

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<sup>102</sup> In order to analyse the different impact of age, occupation, marital status and nationality on the dependent variables, a set of dummy variables (coded 1 for each category in which respondents belonged to, and 0 otherwise) were also considered into the regressions. However, given the small number of observations obtained for most of the variables, they were mainly statistically insignificant. Therefore, it was decided to remove these variables from the analyses and to consider those described in Appendix 4A. This led to higher significance of the estimated parameters.

correct' answer both in the VOLUNTARY scenario (i.e., 'high' and 'very high' provision of effort), and in question Q16 (part b) of the questionnaire (i.e., 'I always recycle'). Alternatively responses with the highest frequency were respectively 'I would contribute at a medium level' (40.94% of respondents) and 'I recycle often' (40.77% of respondents).

#### ***4.3.2.1 Policy changes, instrumentality and environmental morale***

This said, the first issue addressed in the empirical analysis investigates how individuals' contribution to recycling activities varies according to the interaction between government signals and environmental morale. To this end, regression analyses used in this section consider the full sample of respondents interviewed and enrolled in the economics and psychology departments. The analysis also includes an interaction term 'European  $\times$  Bath' (dummy variable, 1 = Europeans living in Bath) to take into account differences in nationalities and in the place of data collection. Results are reported in Tables 4.4 and 4.5.

Table 4.4 reports regression results for the VOLUNTARY scenario. The table shows three groups of estimation results. The first regression considers only the impact of socio-demographic/economic variables. It is followed by a second regression including attitudinal variables. Finally, in addition to the socio-economic and attitudinal variables, the model introduces into the regression analysis the index of environmental morale. This allows gaining better insights regarding the impact of each variable on the dependent variable as most of the covariates might also play a role in explaining different levels of environmental morale. As mentioned above, when using ordered probit regression, estimated coefficients can be interpreted only in terms of their sign and significance level. In particular, estimated parameters provide information in terms of the effects generated on respondents' willingness to strongly contribute to recycling activities. Thus, in order to measure the quantitative effect of the independent variables on the ranking information of the dependent variable, marginal effects were also included in Table 4.4. For simplicity, marginal effects are presented only for the highest score of the willingness to voluntarily

contribute to recycling (i.e., for the answer ‘very high’ to the VOLUNTARY scenario). Results can be interpreted as follows. For the binary independent variables the marginal effects represent the change in the probability of reporting a very high contribution that result from changing the base characteristic, holding all other variables constant at their mean values. For non-binary independent variables in levels, the marginal effects measure the impact of a unit increase of the independent variable on the probability of showing a very high contribution to recycling, evaluated at its mean. Finally, for non-binary independent variables that are included in natural logarithmic form, the marginal effect indicates the probability of reporting a very high contribution to recycling arising from a 1% increase in the underlying independent variable from its mean value.

The table also reports the Ramsey RESET test and the Linktest (*\_hatsq*) test. The former is a test of mis-specification of the model’s functional form, whereas the latter tests the validity of the model specification in terms of the presence of omitted variables. The Ramsey RESET test was performed introducing the predicted values of the dependent variable in their second and third power into the regression and testing the joint significance of the respective coefficient estimates (using a Wald ( $\chi^2$ ) test). The Linktest test employed the predicted values of the dependent variable (i.e., *\_hat*) and its second power (i.e., *\_hatsq*) as the predictors to rebuild the model. A well specified model (with neither omitted variables nor functional specification problems) is then obtained when the variable *\_hat* is statistically significant (since it represents the predicted value from the model), and the variable *\_hatsq* has no predictive power except by chance. In this context, both tests suggest the model is well specified and exclude possible omitted variables (i.e., Prob > |z| > 0.1 in both cases). This result is also strengthened by the statistical significance of the variable *\_hat* in the Linktest (1% level).

Going back to the description of the results, among the socio-demographic/economic variables (see Table 4.4, regression 1) there is strong evidence of gender and age differences. Results suggest that females were more likely to provide a higher contribution to recycling than males (by 2.6%). This result seems to contradict that reached by Barr (2003) in his survey where females played a

major role for waste reduction rather than recycling activities and seems to support the literature on pro-environmental behaviours that highlight that eco-conscious behaviour and attitudes towards the environment are more common in females than males. According to previous analyses (see for example Torgler and García-Valiñas, 2007), the willingness to contribute shows an inverted U-shaped relationship with age, meaning that the willing to voluntarily contribute to recycling tend to increase with age, though in this sample the slope gradually decreases when age reaches just the second category (i.e., 25-34 years)<sup>103</sup>.

It is worth noting that these results remain generally robust when attitudinal variables are introduced (see Table 4.4, regression 2) into the regression analysis and when controlling for risk attitudes. Thus, results show: a smaller negative impact of age meaning that older students were more risk averse than younger ones; and a smaller difference between sexes, which can be related to the fact that women are generally more concerned with the risks associated with a poor quality environment (see Dupont, 2004). However, when ethical considerations are introduced into the analysis (see Table 4.4, regression 3) the coefficient of the variable gender becomes less robust in terms of its size and significance level. A possible explanation for this is that the effect of this variable is partially captured by the index of environmental morale, suggesting evidence for stronger ethical concerns among female. An independent samples *t*-test was used to test this hypothesis ( $t(1163) = -7.97, p < 0.01$ ). In general, the test compares the difference between two independent sample means (here, the mean score of environmental morale) and tests the null hypothesis that the mean difference in the population between two groups (here, males and females) is equal to zero. The test statistic is then defined as the difference between the two independent sample means divided by the pooled standard deviation of the sampling population<sup>104</sup>. Results show that females have a significant higher (14.69) mean score environmental morale relative to males (13.26), providing evidence in favour of gender differences in individuals' sensitiveness towards the environment.

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<sup>103</sup> However, here the effect of age is mostly due to the Italian sample of respondents as in the University of Bath (UK) students belonged mainly to the category 15-24 years.

<sup>104</sup> For a detailed discussion of this test statistic see Blalock (1979), and Howell (2013).

As with other studies in the literature (see for example Torgler and García-Valiñas, 2007), there is no evidence of significant differences between married and unmarried<sup>105</sup> respondents, and between respondents' employment situations in their level of contribution to recycling activities. The variables 'financial satisfaction' (see Do Valle et al., 2004, and Whitmarsh and O'Neill, 2010) and 'religion' seem also not to play a role on the willingness to voluntarily contribute to recycling. According to this survey, Europeans living in Bath were less compliant than people from other nationalities surveyed in Bath and in Florence (see Table 4.4, all regressions). By contrast, in line with predictions (see Table 4.4, regression 1), psychologists were significantly more willing to contribute to recycling than economists. In particular, being trained in Psychology rather than Economics increases the likelihood of highly contributing to recycling activities by 1.8 percentage points. However, likewise the variable gender, these differences become less robust when controlling for attitudinal variables and for environmental morale which represents the most dominant regressor into the analysis. An independent samples *t*-test ( $t(1163) = -8.61, p < 0.01$ ) suggests again that there is a significant difference between individuals' sensitiveness towards the environment, with those who study economics showing a mean score environmental morale (13.55) significantly lower than those who study psychology (15.06). Thus, results provide further evidence into the hypothesis that enrolment into economics is associated with increased instrumental behaviour and free riding.

Considering the attitudinal variables (see Table 4.4, regressions 2 and 3), results show that risk aversion positively and significantly (10% level) affected the willingness to contribute to recycling, and increased the probability of subjects reporting the highest willingness to contribute between 1.4% and 1.6%. Social responsibility and altruistic preferences are also of major importance in the decision to participate in recycling. In particular, high levels of social responsibility and strong altruistic preferences were almost 9% more likely to increase contribution to recycling (see Table 4.4, regression 2). However, trust in government seems not to play a role here.

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<sup>105</sup> Given the small number of observations falling into the categories married, live as a couple, divorced, separated and widowed, it was decided to compare never married (or single) respondents versus those who were (or have been) married.



**Table 4.4**

Voluntary Contribution – Ordered Probit Results (Full sample)

Independent variables	Regression 1		Regression 2		Regression 3	
	$\beta$	M.E.	$\beta$	M.E.	$\beta$	M.E.
<i>Socio-demographic/economic variables</i>						
Female	0.192*** (2.65)	0.026*** (2.69)	0.157** (2.16)	0.020** (2.20)	0.091 (1.24)	0.011 (1.26)
Age	1.11** (2.23)	0.154** (2.23)	1.04** (2.15)	0.138** (2.15)	0.838* (1.71)	0.103* (1.70)
Age <sup>2</sup>	-0.264** (-2.22)	-0.036** (-2.23)	-0.259** (-2.28)	-0.034** (-2.28)	-0.223** (-1.97)	-0.027** (-1.96)
Working student	0.246 (1.74)	0.040 (1.51)	0.202 (1.42)	0.030 (1.25)	0.186 (1.22)	0.026 (1.07)
Never married	0.020 (0.13)	0.003 (0.14)	-0.049 (-0.32)	-0.007 (-0.03)	-0.227 (-1.45)	-0.032 (-1.26)
Financial satisfaction (log)	-0.057 (-0.72)	-0.008 (-0.71)	-0.096 (-1.21)	-0.013 (-1.20)	-0.046 (-0.58)	-0.006 (-0.58)
Importance of religion	-0.006 (-0.22)	-0.001 (-0.22)	-0.039 (-1.43)	-0.005 (-1.42)	-0.024 (-0.86)	-0.003 (-0.86)
European $\times$ Bath	-0.531*** (-8.06)	-0.069*** (-7.35)	-0.50*** (-6.79)	-0.062*** (-6.45)	-0.452*** (-6.22)	-0.052*** (-5.80)
Psychologists	0.129* (1.83)	0.018* (1.80)	0.074 (1.03)	0.010 (1.02)	-0.038 (-0.51)	-0.005 (-0.51)
<i>Attitudinal variables</i>						
Risk aversion			0.120* (1.80)	0.016* (1.74)	0.112* (1.69)	0.014* (1.63)
Trust in government			0.054 (1.35)	0.007 (1.36)	0.040 (0.98)	0.005 (0.99)
Social responsibility (log)			0.470*** (2.69)	0.062*** (2.70)	0.171 (0.99)	0.021 (0.99)
Altruism			0.184*** (4.44)	0.024*** (4.24)	0.109*** (2.63)	0.013*** (2.58)
<i>Ethics</i>						
Environmental morale (log)					1.37*** (8.32)	0.168*** (7.75)
Sample size	1,161		1,160		1,160	
Prob > $\chi^2$	0.000		0.000		0.000	
Pseudo R <sup>2</sup>	0.030		0.044		0.073	
Prob > $\chi^2$ Ramsey RESET Test					0.154	
Prob >  z  Linktest ( <i>_hat</i> ) Test					0.006	
Prob >  z  Linktest ( <i>_hatsq</i> ) Test					0.143	

*Notes:* Marginal effects (M.E.) are estimated for the highest willingness to voluntarily contribute to recycling activities (i.e., outcome 5). \*, \*\*, \*\*\* , denote significance level at 10%, 5%, and 1% respectively. (.) denotes z-score. Robust standard errors. The table includes the Prob >  $\chi^2$  and the Pseudo R<sup>2</sup> for the fitted model. The table also reports the Ramsey RESET test and the Linktest (*\_hatsq*) test for the full model specification.

Table 4.4. (see regression 3) shows that, as with other variables in the regression analysis, when the index of environmental morale is introduced into the regression analysis most of the attitudinal variables become less robust in terms of their size and significance level. This is particularly the case of the variables ‘trust in government’ (though not significant), ‘social responsibility’ and ‘altruism’. A possible explanation for this is that these variables (in addition to the socio-economic/demographic variables) might play an important role in determining individuals’ environmental morale, thus lending support to the hypothesis (see Chapter 2) that environmental morale can be driven by feelings of altruism, needs to conform to norms and reciprocal preferences (proxied in the regression analyses by the variables ‘social responsibility’ and ‘trust in government’, respectively).

Finally, the index of environmental morale has the expected sign and it is highly significant (1% level), suggesting strong evidence into the importance of ethical considerations for the provision of recycling activities. In particular, results show that a 1% increase in the level of environmental morale increases the willingness to contribute to recycling by 16.8% points. However, given the nature of the index of environmental morale (which is expressed in logarithmic form), results seem to indicate that this effect slows down when the index reaches high levels, thus suggesting that differences in respondents’ contribution to recycling become smaller among those who already exhibit high levels of environmental morale<sup>106</sup>.

In order to capture individuals’ reactions to policy changes according to their underlying motivation, the ranking of answers to the BIN and FINE scenarios were regressed on all socio-demographic/economic and attitudinal variables using multinomial regression analyses. Multinomial regression analyses are based on the independence of irrelevant alternatives assumption (IIA), which implies that the odds of one outcome are not related to the availability of another outcome. The full model

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<sup>106</sup> In addition to the Ramsey Reset Test and Linktest, the robustness of these results was also assessed using a binomial probit regression for the full model (results not reported here), where the highest outcomes of the willingness to contribute (i.e., outcomes 4 and 5) were converted into 1 (and all other values = 0). In general results remained robust, though moving from the ordered probit to the probit changed the statistical significance of some of the estimated parameters albeit their sign stayed the same.

(as in Table 4.4, regression 3) passed the (suest-based) Hausman test (see Long and Freese, 2006), thus confirming the validity of this assumption (results are reported in Appendix 3B). In addition, a direct check on the correlation coefficient and some preliminary OLS estimations revealed (results not reported here) that no multicollinearity problems existed between the explanatory variables of all models considered in this analysis. Given the focus of this section on the effect of environmental morale on the willingness to contribute to recycling, Table 4.5 reports only the estimated associations between the willingness to change effort and the individuals' level of environmental morale. Full results are reported in Appendix 4B.

**Table 4.5**

Willingness to change effort relative to category 1 (= same level of effort)

Model	Environmental Morale (log)		
	$\beta$	z-score	M.E.
<i>Bin scenario</i>			
Increase	-0.585	-1.59	-0.063
Decrease	-2.309***	-4.00	-0.068***
Same level of effort	-	-	0.132*
<i>Fine scenario</i>			
Increase	-1.392***	-4.05	-0.283***
Decrease	-2.635***	-3.31	-0.022**
Same level of effort	-	-	0.306***
Sample size		1,160	

*Notes:* Multinomial logit regression analyses. Full model as in Table 4.4 (regression 3). The reference category is 1 (= same level of effort). M.E. represents marginal effects. In the BIN scenario the sample size = 1,160 (willingness to increase effort = 784, willingness to decrease effort = 56). In the FINE scenario the sample size = 1,160 (willingness to increase effort = 753, willingness to decrease effort = 36). \*, \*\* and \*\*\* indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Robust standard errors.

In general the results in both scenarios show that higher levels of environmental morale are significantly and negatively correlated (not significant for increase effort in the BIN scenario)<sup>107</sup> with the willingness to change the provision of effort in both directions (i.e., increasing or decreasing effort). Among other reasons, a possible explanation for this is that, given their higher initial level of environmental morale, individuals were indifferent to changes in policy measures to enforce recycling behaviours (Feldman and Perez, *forthcoming*). However, data seem also to suggest

<sup>107</sup> The insignificant relationship between environmental morale and increasing effort in the BIN scenario might be due to the fact that a significant proportion of respondents with high environmental morale were likely to state they would increase their level of effort with the policy improvement (see Table 4.2 above).

that people in the BIN scenario were more likely to respond to policy change. Indeed, the relative probability of choosing to maintain the same level of efforts *versus* the other two outcomes increases in the BIN and the FINE scenarios respectively by 13.2% (at 10% significance level) and 30.6% (at 1% significance level) for every percentage point increase in the level of environmental morale above the average.

#### ***4.3.2.2 What shapes environmental morale?***

Having established the relevance of environmental morale to individuals' responses to policy signals, this section focuses on the determinants of environmental morale. As discussed in the previous section, most of the socio-demographic/economic and attitudinal variables might also play a role in explaining what shapes environmental morale. In order to analyse these aspects, Table 4.6 reports regression results of all socio-demographic/economic and attitudinal variables on environmental morale<sup>108</sup>. In general, results shown in Table 4.6 follow the same pattern of those presented in Table 4.4 in terms of the signs and significance levels of the estimated coefficients (although they differ in their relative magnitude). This not only suggest a strong correlation between environmental morale and the willingness to voluntarily contribute to recycling activities (Pearson correlation is 0.36, significant at the 1% level), but also intimates that social responsibility and altruism play an important role in determining individuals' moral obligation towards the environment. However, the variable 'trust in government' remains insignificant, thus suggesting that environmental morale and, more generally, voluntary contribution to the environment are less likely to be influenced by individuals' trust in government when policy measures are not taken into account<sup>109</sup>.

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<sup>108</sup> The Ramsey RESET test and the Linktest test suggested the employment of a level-log model specification ( $\text{Prob} > |t| > 0.1$  in both cases). However, differently from the ordered probit regression analysis, the Ramsey RESET test was performed here introducing the predicted values of the dependent variable in their second, third and fourth power into the regression and testing the joint significance of the respective coefficient estimates (i.e., using an  $F$ -test).

<sup>109</sup> Looking at Tables 4B.3 and 4B.2 in Appendix 4B, trust in government seems to play a major role when taking into account a change in policy schemes. This, in addition to responses to the follow-up questions (see Table 4.2) strengthen the conclusion that reciprocal preferences do play a role in driving individuals' behaviour and motivation towards the environment.

**Table 4.6**  
Environmental morale - OLS Results (Full sample)

Independent Variables	Regression1	Regression2
	$\beta$	$\beta$
<i>Socio-economic demographic variables</i>		
Intercept	10.187*** (6.76)	1.508 (0.76)
Female	0.853*** (4.39)	0.701*** (3.80)
Age	3.181** (1.98)	2.762* (1.91)
Age2	-0.601* (-1.57)	-0.546 (-1.57)
Working student	0.306 (0.81)	0.150 (0.43)
Never married	1.531*** (2.96)	1.187*** (2.69)
Financial satisfaction (log)	-0.454** (-2.08)	-0.612*** (-3.18)
Importance of religion	-0.011 (0.16)	-0.134** (-1.90)
European $\times$ Bath	-0.913*** (-5.31)	-0.747*** (-3.95)
Psychologists	1.369*** (7.74)	1.086*** (6.11)
<i>Attitudinal variables</i>		
Risk aversion		0.126 (0.73)
Trust in government		0.157 (1.53)
Social responsibility (log)		2.514*** (4.47)
Altruism		0.727*** (7.37)
Sample size	1,161	1,160
Prob > F	0.000	0.000
R <sup>2</sup>	0.168	0.127
Prob > F Ramsey RESET Test		0.319
Prob >  t  Linktest ( <i>_hat</i> ) Test		0.021
Prob >  t  Linktest ( <i>_hatsq</i> ) Test		0.269

*Notes:* \*, \*\*, \*\*\* denote significance level at 10%, 5%, and 1% respectively. Robust standard errors. (.) denotes *t*-statistic. The table includes the Prob > F and the R<sup>2</sup> for the fitted model. The table also reports the Ramsey RESET test and the Linktest (*\_hatsq*) test for the full model specification.

This said, moving from Table 4.4. to Table 4.6, a few differences can be observed that require some explanation<sup>110</sup>. Among the socio-demographic/economic variables there is evidence of significant differences between the levels of environmental morale of those who were not married and those who were (or have been) married with never married people showing higher environmental morale than that of different marital statuses. This result seems to be in contrast with findings of Torgler et al. (2009), where the authors conclude that in general married people are more compliant and exhibit high environmental morale compared to 'singles'. However, given the lack of variation in all other marital status categories, it might be argued that results in this case can be biased by the sample characteristics and should therefore be interpreted with caution.

Different to previous analyses (see e.g. Torgler and Garcia-Valiñas, 2007) Table 4.6 also provides evidence of a negative relationship between financial satisfaction and environmental morale. In particular, a one percentage increase in the level of financial satisfaction is associated with a modest decrease of individuals' environmental morale (between 0.0045 and 0.0061). Interestingly, this relationship becomes stronger in size when attitudinal variables are introduced into the regression. A possible explanation for this can be that, depending on risk preferences, the perception of a higher financial satisfaction might have led individuals to be less willing to bear the time and trouble costs of eco-conscious behaviours as they might contribute to environmental protection through different channels (e.g., monetary payments). Alternatively, those who considered their financial situation extremely disappointing might have been more reluctant to take risks related to environmental degradation because of high marginal utility loss (in terms of health reduction), which, in this context, translates into higher environmental morale and concern. This argument is in line with prospect theory that states that people evaluate gains and losses relative to a reference point (see for example Kahneman and Tversky, 1979). Individuals might have compared their actual situation (reference point) with a hypothetically worse scenario where no one would take any actions towards the environment and evaluated losses and gains of doing so in their social environment. A further aspect to point out is that results from this survey do not contradict the

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<sup>110</sup> Also in this case a binary probit regression analysis (where, 1 = index of environmental morale > 12, and 0 otherwise) lend support to the robustness of the results.

existence of an environmental Kuznets curve given that what affects the willingness to contribute to environmental protection might not be necessarily related to what affects environmental morale and *vice versa*.

Finally, results highlight a negative relationship between religion and environmental morale. In particular, Table 4.6 (regression 2) shows that, as the importance of religion increases, the level of environmental morale decreases by 0.134 (at the 5% significance level). The question included in the survey served as a proxy for “religious identity salience” (see Torgler, 2007, p.118). In contrast with predictions, results from this survey seem to contradict the long-held belief in the literature that religious people tend to be more compliant and charitable. Specifically, internalized religious convictions here did not lead either to higher environmental morale or to an increase of voluntary contribution to recycling (see also Table 4.4). Although this finding might appear surprising, a possible explanation for this can be that respondents who declared religion is very important in their life might not have internalized religious values and, as suggested by Malhotra (2011), they might be more likely than non-religious individuals to behave pro-socially only when they attend their place of worship (i.e., *Sunday effect*). On the other hand, it is also possible that there can be other non-God related stimuli that led non-religious individuals to exhibit higher environmental morale and to behave eco-consciously (see Shariff and Norenzayan, 2007, and Malhotra, 2011). However, this remains a question of future research since the methodology employed in this study cannot disentangle the different reasons that guide non-religious individuals to be more environmentally-friendly. Note that the negative relationship between environmental morale and religion is strengthening when controlling for altruism as the coefficient of the variable ‘religion’ becomes more robust in its size and significance level. This seems to suggest that there might be other variables that influence altruistic behaviours rather than religion beliefs.

#### ***4.3.2.3 The impact of culture on individuals’ attitudes towards recycling***

The last issue investigated in the empirical analysis concerns the effect of nationality on the willingness to voluntarily contribute to recycling activities. Regression results are reported in short in Table 4.7 which restrict the analysis to the European sample

of respondents where two dummy variables for Italian and British have replaced the interaction term 'European  $\times$  Bath' in Table 4.4. Full results are reported in Appendix 3B.

Results show that controlling for individuals' level of environmental morale and all other covariates (see Table 4.7, regression 3), Italian and British respondents show different attitudes towards recycling if compared to all other Europeans. In particular, Italians were more willing to contribute to recycling (at the 10% significant level, with a marginal effect of 2.8%) than other Europeans, while the British were less willing to do so on a voluntary basis (at the 5% significance level, with a marginal effect of 3.9%). A possible interpretation of this result can be that, if the variation in individuals' attitudes towards the environment can be attributed both to differences in culture and their level of environmental morale, then the difference in the differences between Italian and British (Wald test = 49.76,  $p < 0.01$ ) can be attributed to the net effect of environmental morale on respondents' view. An independent samples  $t$ -test ( $t(970) = -4.15, p < 0.01$ ) suggests indeed that on average there is a significant difference between Italian respondents' environmental morale (14.49) and that of British (13.69). Given the available statistics (see Chapter 3, Appendix 3A), this result might appear surprising. However, rather than a discrepancy between actual and self-reporting behaviours, this can be a consequence of the geographical area in which respondents were interviewed. According to the latest available ISTAT's report (2012), in fact, the amount of sorted and collected waste in Florence reached 40.2% in 2011, a value that is a long way away from the average percentage value registered in the central of Italy (i.e., 30%). Therefore in Florence respondents might be more open to recycling activities than in other areas of central Italy. Nevertheless, it is worth emphasizing that different results could have been reached by considering a broader sample of respondents (e.g., including data from the south of Italy).



**Table 4.7**

Voluntary Contribution – Ordered Probit Results (European sample)

Independent variables	Regression 1		Regression 2		Regression 3	
	$\beta$	M.E.	$\beta$	M.E.	$\beta$	M.E.
Italian	0.235*	0.030*	0.225	0.028	0.240*	0.028*
	(1.67)	(1.68)	(1.61)	(1.61)	(1.73)	(1.73)
British	-0.373***	-0.046***	-0.385***	-0.046***	-0.350**	-0.039**
	(-2.60)	(-2.66)	(-2.74)	(-2.82)	(-2.53)	(-2.59)
Sample size	1,040		1,039		1,039	
Prob > $\chi^2$	0.000		0.000		0.000	
Pseudo R <sup>2</sup>	0.038		0.047		0.073	
Prob > $\chi^2$ Ramsey RESET Test					0.101	
Prob >  z  Linktest ( <i>_hat</i> )					0.005	
Prob >  z  Linktest ( <i>_hatsq</i> )					0.105	

*Notes:* As in Table 4.4.

## 4.4 DISCUSSION OF RESULTS AND CONCLUSIONS

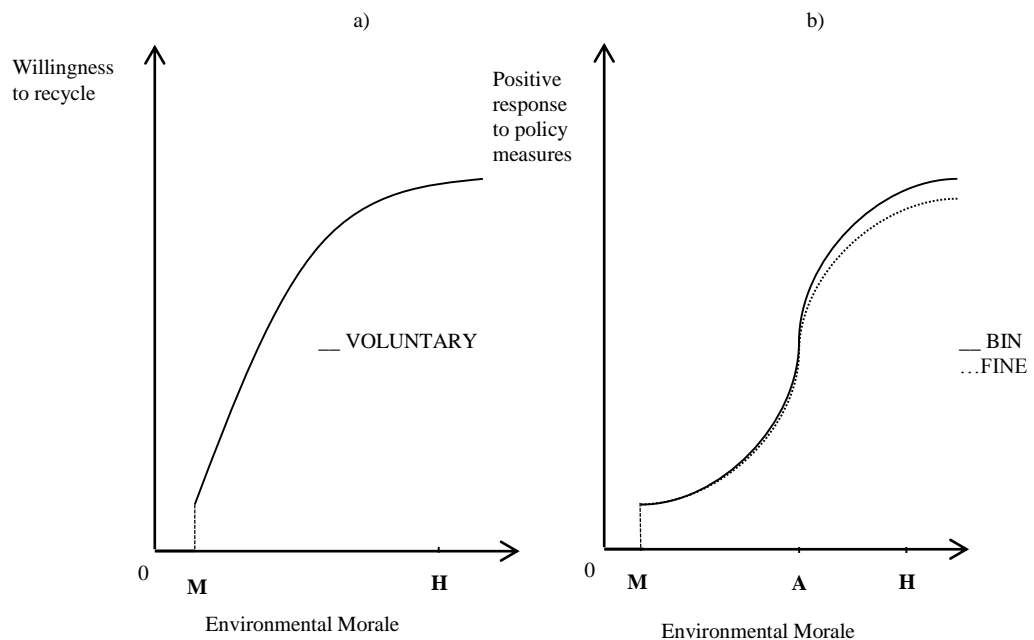
### 4.4.1 Discussion of results

This section briefly discusses the main results obtained in this study. Figure 4.2 provides a stylised presentation of them.<sup>111</sup> As shown in the figure, low environmental morale in the interval 0-M leads respondents to be unwilling to contribute to recycling (see Figure 4.2 (a)). However, when the level of environmental morale reaches a certain level (i.e., M), the willingness to contribute to recycling tends to increase considerably – i.e., the curve has a discontinuity at M. As can be seen at high levels of environmental morale (beyond H) there is not much variation among respondents' contribution. Therefore, the figure suggests that major differences in individuals' level of contribution can be found between M and H. Figure 4.2 (b) shows that the relationship between positive responses to policy measures and environmental morale has a S shape. In particular, individuals' responsiveness to policy measures rapidly increase towards an inflection point (i.e., A – corresponding to a medium level of environmental morale), followed by a further increase in a curve that whilst increasing it does so at a decreasing rate. The tapering occurs when the level of environmental morale departs from a medium

<sup>111</sup> Results are focused on the willingness to voluntarily contribute to recycling and on positive responses to policy measures (i.e., willingness to increase effort's provision). The small number of observations of negative responses to policy measures (i.e., willingness to decrease effort's provision) does not allow a vivid representation of the results.

value. At this point responsiveness to policy measures slows down, especially when environmental morale reaches very high levels (i.e., H). A possible explanation for this is that for respondents who in the voluntary scenario made a high contribution (i.e., H and beyond in Figure 4.2 (b)) the policy instruments have no impact because, as far as they were concerned, they were already making a maximum contribution. Again, the figure shows a point of discontinuity in the function (i.e., M), meaning that individuals seem not to react to policy measures for a lower level of environmental morale (i.e., between the interval 0-M).

**Figure 4.2:** The impact of environmental morale on recycling



In summary, results in this survey suggest that individuals' voluntary contribution to recycling and reactions to policy measures depends on their initial level of environmental morale. However, effects seem to be neutral for those who initially exhibit high environmental morale. According to Figure 4.2 (b), it is also evident that responsiveness to policy measures is higher in the BIN scenario (see the solid line in Figure 4.2 (b)), thus illustrating the hypothesis that facilitating *nudge* policy measures tend to encourage recycling more than mandatory schemes.

This result has important consequences from a policy perspective and has a role in the ongoing debate over the voluntary/mandatory nature of recycling schemes. On the one hand, mandatory schemes might serve as a deterrent to not recycling. On the other hand, sceptics argue that mandatory measures may create feelings of pressure (by forcing people to comply) and may result in other irresponsible behaviours (e.g., fly tipping), and further that they do not serve as instruments to acknowledge the importance of environment. This raises the question of how to motivate people to value what may appear to be non-interesting and externally motivated activities with a view to fostering autonomous regulation. Results from this survey suggest that a facilitating *nudge* policy measure might be more effective in generating a positive effect on the individuals' perception that recycling is 'the right thing to do'.

#### **4.4.2 Conclusions**

This chapter describes the empirical results of the questionnaire survey presented in chapter 3. The study investigates the linkage between government signals and individuals' willingness to contribute to recycling according to their underlying motivation. Furthermore the analysis helps an understanding of what shapes environmental morale. In line with predictions, the empirical findings suggest that environmental morale plays a major role in motivating individuals' contribution to recycling. The description of the follow-up responses and empirical results described in previous sections generally support this conclusion. As expected, environmental morale seems to be driven by feelings of altruism, needs to conform to social norms and reciprocal preferences.

The differences between the levels and the reasons for respondents' reactions to policy changes lend support to the hypothesis that individuals react to government policies not only according to their level of environmental morale (*Hypothesis 2*), but also according to the nature of the signals generated by different policies (*Hypothesis 1*). In particular, according to results obtained from this analysis recycling can be better fostered with facilitating *nudge* policy measures than with mandatory schemes.

The results reported in this study also indicate that there is a difference in individuals' sensitiveness towards the environment (*Hypothesis 3*). According to previous survey analyses and laboratory experiments (see Frank et al., 1993; Selten and Ockenfels, 1998; Torgler et al., 2009), there is a strong effect of gender, with females showing greater environmental morale and willingness to voluntarily contribute to recycling activities. In addition, in line with the tax compliance literature (e.g. Cullis et al., 2006; Cullis et al., 2012) instrumental behaviour (i.e. free riding) seems to be stronger amongst those exposed to economics teaching. This result corroborates previous evidence over the hypothesis that exposure to different indoctrination may influence the way in which individuals behave, especially when facing situations that require a trade-off between profit/utility maximization and ethical considerations. Indeed, students trained in psychology tend to be generally more willing to contribute to recycling, a predisposition that according to results obtained from this analysis can be attributed to higher levels of environmental morale<sup>112</sup>. Regarding the effect of culture, results suggest that in countries with lower level of environmental morale, individuals' willingness to contribute to recycling is also poor.

This said, it is also important to acknowledge that the survey is based on students' responses and on hypothetical scenarios rather than on a representative sample of households and their actual behaviour. This might explain why there was not very much variation in many of the socio/demographic – economic indicators (e.g., age, financial satisfaction, occupational and marital status). However, a growing experimental literature relies on students' responses and as suggested by Alm and Jacobson (2007, p. 143) “there is no reason to believe that the cognitive processes of students are different from those of “real” people”. Regarding the hypothetical bias of stated preferences methods it might be argued that this problem seems to play a major role in fostering misleading conclusions for quantitative analyses rather than for qualitative ones. The purpose of this study was not to assess

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<sup>112</sup> As mentioned in Chapter 3, it is common practice in the behavioural economics literature to compare different attitudes and behaviours using experiments and/or survey analyses taken from psychology and economics students. However, it might be of interest to extend in future research the survey to a broader sample of students to further explore how different indoctrination might affect individuals' behaviour.

which is the best policy to adopt in order to encourage individuals to recycling activities among those mentioned in the hypothetical settings, but to shed light on how individuals react (in terms of intrinsic motivation) to different policy schemes (i.e., signals). Thus, this bias seems not to play a major part here. In addition, hypothetical scenarios served to reduce ‘socially acceptable’ responses bias (see Orviska and Hudson, 2003). Furthermore, although it is important to recognize the relevance of these criticisms it has to be recognised that the costs of extending the survey to a broader sample of respondents or to analyse these aspects in a ‘real life’ experiment are large.

The results here provides a contribution to that part of the literature that indicates that monetary incentives (i.e., taxes, subsidies and fines) can be counterproductive and undermine environmental morale as the intrinsic motivation to contribute to a better environment. A good understanding of the interaction between external regulations and individuals’ environmental morale is relevant when designing policy measures to deter free-riding.

## APPENDIX 4A: DEFINITION AND DESCRIPTION OF VARIABLES

**Table 4A.1**  
Description of the variables

Variable	Description	Expected Sign
<i>Dependent variables</i>		
Voluntary contribution	Ordinal variable that assumes values 1=I will do hardly any recycling to 5=very high	N/A
Willingness to change effort (BIN scenario)	Categorical variable that assumes value 1=I would exert the same level of effort, 2/3=I would increase/decrease my effort	N/A
Willingness to change effort (FINE scenario)	Same as in BIN scenario	N/A
<i>Independent variables</i>		
Female	Dummy coded 1 if female and 0 if male	+
Age	Ordinal variable that assumes values 1(15-24) to 5(55-64)	+/-
Age <sup>2</sup>	Square of variable 'age'	+/-
Working student	Dummy coded 1 if working student and 0 otherwise	+/-
Never married	Dummy coded 1 if never married and 0 otherwise	+/-
Financial satisfaction (log)	Log of the degree of respondents' financial satisfaction (1=extremely dissatisfied, 10=extremely satisfied)	+
Importance of religion	Ordinal variable that assumes values 1=not at all important to 5=very important	+
Italian	Dummy coded 1 if Italian and 0 otherwise	-
British	Dummy coded 1 if British and 0 otherwise	+
European × Bath	Dummy coded 1 if european and 0 otherwise	+/-
Psychologists	Dummy coded 1 if psychologist and 0 otherwise	+
Risk aversion	Dummy coded 1 if risk averse and 0 otherwise	+/-
Trust in government	Ordinal variable that assumes values 1=none at all to 5=a great deal	+
Social responsibility (log)	Log of respondents' level of social responsibility (multi-item index ranging from 4 to 20)	+
Altruism	Ordinal variable that assumes values 1=not at all important to 5=very important	+
Environmental morale (log)	Log of respondents' environmental morale (multi-item index ranging from 4 to 20)	+

**Table 4A.2**  
Descriptive statistics

Variable	Obs	Mean	Std.dev.	Min	Max
Voluntary contribution	1165	3.295	0.918	1	5
Facilitating nudge (BIN)	1165	1.769	0.523	1	3
Enforcing (FINE)	1165	1.708	0.518	1	3
Female	1165	0.623	0.484	0	1
Age	1165	1.064	0.334	1	5
Age <sup>2</sup>	1165	1.244	1.462	1	25
Working	1165	0.064	0.245	0	1
Never married	1165	0.941	0.234	0	1
Financial satisfaction (log)	1161	1.797	0.444	0	2.302
Importance of religion	1165	2.175	1.240	1	5
Italian	1165	0.484	0.499	0	1
British	1165	0.349	0.476	0	1
European $\times$ Bath	1165	0.4	0.490	0	1
Psychologists	1165	0.397	0.489	0	1
Risk aversion	1164	0.337	0.473	0	1
Trust in government	1165	2.431	0.895	1	5
Social responsibility (log)	1165	2.767	0.207	1.386	2.995
Altruism	1165	3.713	0.922	1	5
Environmental morale (log)	1165	2.622	0.252	1.386	2.995

*Notes:* The table reports the total number of observations (Obs.), the mean value (Mean), the standard deviation (SD), and the minimum/maximum value (i.e., Min and Max, respectively) of the variables included in the regression analyses.

## APPENDIX 4B: FULL RESULTS FOR MULTINOMIAL REGRESSIONS AND ORDERED PROBIT (EFFECT OF CULTURE)

**Table 4B.1**

(Suest-based) Hausman test for Independence of Irrelevant Alternatives (IIA)

BIN scenario				
Omitted	chi <sup>2</sup>	Df	Prob > chi <sup>2</sup>	Evidence
2	13.534	15	0.561	for Ho
3	12.001	15	0.679	for Ho
1	15.090	15	0.445	for Ho
FINE scenario				
Omitted	chi <sup>2</sup>	Df	Prob > chi <sup>2</sup>	Evidence
2	15.961	15	0.385	for Ho
3	9.027	15	0.876	for Ho
1	7.371	15	0.947	for Ho

*Notes:* The (suest-based) Hausman test for IIA tests the null hypothesis that the odds for each specific pair of outcomes are independent of other alternatives. A Prob > chi<sup>2</sup> > 0.05 indicates that the null hypothesis of independent alternatives cannot be rejected.



**Table 4B.2**

Willingness to change effort in the BIN scenario – Multinomial Logit Results (Full sample)

Independent variables/effort	Same effort	Increase effort		Decrease effort	
	M.E.	$\beta$	M.E.	$\beta$	M.E.
<i>Socio-economic demographic variables</i>					
Intercept	-	1.592 (1.10)	-	-0.170 (-0.31)	-
Female	-0.049 (-1.60)	0.235 (1.54)	0.039 (1.25)	0.442 (1.37)	0.009 (0.92)
Age	-0.029 (-0.16)	0.126 (0.14)	0.011 (0.06)	0.585 (0.47)	0.017 (0.48)
Age <sup>2</sup>	0.018 (0.46)	-0.094 (-0.45)	-0.016 (-0.41)	-0.123 (-0.46)	-0.001 (-0.26)
Working student	0.014 (0.26)	-0.028 (-0.10)	0.016 (0.29)	-1.433 (-1.33)	-0.030** (-2.36)
Never married	0.015 (0.26)	-0.069 (-0.22)	-0.006 (-0.11)	-0.279 (-0.51)	-0.009 (-0.42)
Financial satisfaction (log)	-0.018 (-0.57)	0.949 (0.58)	0.018 (0.59)	0.053 (0.15)	-0.000 (-0.05)
Importance of religion	-0.016 (-1.38)	0.081 (1.37)	0.015 (1.28)	0.085 (0.73)	0.000 (0.25)
European $\times$ Bath	-0.113*** (-3.73)	0.647*** (3.86)	0.143*** (4.62)	-0.423 (-1.12)	-0.030*** (-2.74)
Psychologists	0.071** (2.27)	-0.385** (-2.43)	-0.084** (-2.58)	0.058 (0.17)	0.012 (0.69)
<i>Attitudinal variables</i>					
Risk aversion	0.022 (0.77)	-0.103 (-0.71)	-0.014 (-0.49)	-0.297 (-0.92)	-0.007 (0.76)
Trust in government	-0.048*** (-2.95)	0.261*** (3.11)	0.056*** (3.32)	-0.045 (-0.22)	-0.008 (-1.20)
Social responsibility (log)	-0.010 (-0.15)	0.066 (0.18)	0.018 (0.26)	-0.170 (-0.31)	-0.007 (-0.46)
Altruism	0.023 (1.35)	-0.119 (-1.36)	-0.023 (-1.32)	-0.087 (-0.31)	-0.000 (-0.01)
<i>Ethics</i>					
Environmental morale (log)	0.132* (1.84)	-0.585 (-1.59)	-0.063 (-0.90)	-2.309*** (-4.00)	-0.068*** (-3.56)
Sample size		1,160		1,160	
Prob > chi <sup>2</sup>		0.000		0.000	
Pseudo R <sup>2</sup>		0.058		0.058	

*Notes:* Multinomial logit regression analyses. Full model as in Table 4.4 (regression 3). The reference category is 1 (= same level of effort). M.E. represents marginal effects. (.) denotes z-score. In the BIN scenario the sample size = 1,160 (willingness to increase effort = 784, willingness to decrease effort = 56). \*, \*\* and \*\*\* indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Robust standard errors.

**Table 4B.3**

Willingness to change effort in the FINE scenario – Multinomial Logit Results (Full sample)

Independent variables/effort	Same effort	Increase effort		Decrease effort	
	M.E.	$\beta$	M.E.	$\beta$	M.E.
<i>Socio-economic demographic variables</i>					
Intercept	-	4.616*** (3.38)	-	6.455** (2.46)	-
Female	-0.032 (-1.01)	0.185 (-1.27)	0.055* (1.73)	1.272*** (-2.74)	-0.023** (-2.14)
Age	0.112 (0.55)	-0.624 (-0.66)	-0.180 (-0.89)	4.763** (2.30)	0.068** (2.26)
Age <sup>2</sup>	-0.006 (-0.14)	0.053 (0.24)	0.021 (0.43)	-1.031* (-1.91)	-0.014* (-1.84)
Working student	0.062 (0.98)	-0.292 (-1.07)	-0.071 (-1.13)	0.352 (0.65)	0.009 (0.87)
Never married	-0.115 (-1.63)	0.484 (1.66)	0.104 (1.48)	1.810** (2.03)	0.011*** (2.88)
Financial satisfaction (log)	-0.011 (-0.34)	0.049 (0.32)	0.008 (0.27)	0.227 (0.45)	0.002 (0.41)
Importance of religion	-0.025** (-2.06)	0.116** (2.02)	0.024* (1.94)	0.204 (1.37)	0.001 (0.89)
European $\times$ Bath	-0.094*** (-2.94)	0.438*** (2.79)	0.087*** (2.67)	0.861** (1.96)	0.007 (1.16)
Psychologists	-0.023 (-0.74)	0.099 (0.66)	0.016 (0.49)	0.620 (1.28)	0.007 (1.07)
<i>Attitudinal variables</i>					
Risk aversion	0.003 (0.13)	-0.007 (-0.05)	0.003 (0.10)	-0.587 (-1.21)	-0.007 (-1.34)
Trust in government	-0.021 (-1.22)	0.115 (1.43)	0.032* (1.83)	-0.744*** (-2.66)	-0.010*** (-2.75)
Social responsibility (log)	0.061 (0.82)	-0.248 (-0.72)	-0.037 (-0.51)	-1.942*** (-3.36)	-0.023*** (-2.61)
Altruism	0.025 (1.47)	-0.114 (-1.40)	-0.021 (-1.23)	-0.400* (-1.89)	-0.004* (-1.70)
<i>Ethics</i>					
Environmental morale (log)	0.306*** (4.18)	-1.392*** (-4.05)	-0.283*** (-3.89)	-2.635*** (-3.31)	-0.022** (-2.33)
Sample size		1,160		1,160	
Prob > chi <sup>2</sup>		0.000		0.000	
Pseudo R <sup>2</sup>		0.078		0.078	

*Notes:* Multinomial logit regression analyses. Full model as in Table 4.4 (regression 3). The reference category is 1 (= same level of effort). M.E. represents marginal effects. (.) denotes z-score. In the FINE scenario the sample size = 1,160 (willingness to increase effort = 753, willingness to decrease effort = 36). \*, \*\* and \*\*\* indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Robust standard errors.

**Table 4B. 4**

The effect of culture - Ordered Probit Results (European sample)

Independent Variables	Regression 1		Regression 2		Regression 3	
	$\beta$	M.E.	$\beta$	M.E.	$\beta$	M.E.
<i>Socio-economic demographic variables</i>						
Female	0.235*** (3.04)	0.029*** (3.08)	0.200** (2.54)	0.024** (2.58)	0.154* (1.95)	0.017** (1.97)
Age	1.328** (2.33)	0.175** (2.32)	1.240** (2.19)	0.158** (2.18)	1.143* (1.91)	0.136* (1.90)
Age <sup>2</sup>	-0.307** (-2.16)	-0.040** (-2.15)	-0.297** (-2.10)	-0.037** (-2.10)	-0.292** (-1.98)	-0.034** (-1.96)
Working student	0.219 (1.50)	0.033 (1.31)	0.195 (1.31)	0.028 (1.16)	0.184 (1.16)	0.024 (1.02)
Never married	0.111 (0.75)	0.013 (0.81)	0.047 (0.32)	0.005 (0.33)	-0.104 (-0.67)	-0.013 (-0.62)
Financial satisfaction (log)	-0.0954 (-1.19)	-0.012 (-1.17)	-0.132 (-1.65)	-0.016 (-1.62)	-0.066 (-0.82)	-0.007 (-0.81)
Importance of religion	0.001 (0.05)	0.000 (0.05)	-0.027 (-0.92)	-0.003 (-0.92)	-0.008 (-0.27)	-0.000 (-0.27)
Italian	0.235* (1.67)	0.030* (1.68)	0.225 (1.61)	0.028 (1.61)	0.240* (1.73)	0.028* (1.73)
British	-0.373*** (-2.60)	-0.046*** (-2.66)	-0.385*** (-2.74)	-0.046*** (-2.82)	-0.350** (-2.53)	-0.039** (-2.59)
Psychologists	0.056 (0.76)	0.007 (0.76)	0.028 (0.37)	0.003 (0.37)	-0.090 (-1.15)	-0.010 (-1.16)
<i>Attitudinal variables</i>						
Risk aversion			0.053 (0.75)	0.006 (0.74)	0.448 (0.63)	0.005 (0.62)
Trust in government			0.088** (2.01)	0.011** (2.02)	0.092** (2.04)	0.011** (2.05)
Social responsibility (log)			0.402** (2.11)	0.051** (2.10)	-0.090 (-0.45)	-0.010 (-0.45)
Altruism			0.154*** (3.56)	0.019*** (3.46)	0.089** (2.05)	0.010** (2.03)
<i>Ethics</i>						
Environmental morale (log)					1.305*** (-7.33)	0.156*** (7.00)
Sample size	1,040		1,039		1,039	
Prob > $\chi^2$	0.000		0.000		0.000	
Pseudo R <sup>2</sup>	0.038		0.047		0.073	
Prob > $\chi^2$ Ramsey RESET Test					0.101	
Prob >  z  Linktest ( <i>_hat</i> ) Test					0.005	
Prob >  z  Link Test ( <i>_hatsq</i> ) Test					0.105	

*Notes:* As in Table 4.4.

## Chapter 5

### DISCOUNTING THE ENVIRONMENT

*“Completely ignoring the side effects of the action would make it dishonest, but unlimited responsibility would make it impossible. It is indeed a sign of human limitations that the disparity between the desired effects and the innumerable consequences of the action is itself unmanageable, and calls upon the practical wisdom gained throughout the history of earlier trade-offs. A happy medium must be found between escaping from the responsibility for consequences and the inflation to infinity responsibility.” (Ricoeur, 1995, p.68).*

#### 5.1 INTRODUCTION

The current debate is not only over which actions should be adopted to mitigate the impact of environmental damages, but also over how citizens evaluate the costs of mitigation and/or the environmental consequences today versus those of future generations. Human life is full of decisions involving a stream of outcomes that occur at different times in the future. People commonly trade off current sacrifices for a better future: they invest in their human capital, save money for their retirement and plan their own future and those of future generations to whom they want to provide bequests. The rate at which future outcomes are weighted is commonly known in the literature as the discount rate, “which can be interpreted as the minimum rate of return required from a safe investment project to make it socially desirable to implement” (Gollier, 2011 p. 6).

Likewise other daily-life investments, investments in environmental projects today (e.g. those related to global warming and climate change prevention) need to be compared with future benefits. There are at least two interrelated reasons for doing so: sustainable development and intergenerational equity concerns<sup>113</sup>. The

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<sup>113</sup> The link between the two concepts has been analysed for example by Hartwick (1978), Solow (1986), Weiss (1992) and Arrow et al. (1996).

former, whose notion is widely discussed in Bruntland (1987), refers to the idea that economic development should guarantee the improvement of policies to maintain intact (or enhance) ‘natural’ capital (see Markandya and Pearce, 1991). Put in another way, the necessity to meet the needs of the present generation should not prevent future generations from meeting their own needs (see United Nations, 1987, cited by Koundouri, 2009). The latter advocates that policies and investments made in the present generation “should contribute to securing sustained increases in welfare for future generations” (see Atkinson et al., 1997, cited by Groom et al., 2005, p. 447). As suggested by Beder (2000) equity relates to social justice and to the need for fairness (and not necessarily for equality) in the distribution of gains and losses. Equity should simply ensure to everyone an acceptable quality and standard of living. In particular, “...Equity means that there should be a minimum level of income and environmental quality below which nobody falls. Within a community it usually also means that everyone should have equal access to community resources and opportunities, and that no individuals or groups of people should be asked to carry a greater environmental burden than the rest of the community as a result of government actions...” (Beder, 2000, p. 228). Extended to the concept of intergenerational equity, the idea is that although future generations might gain from economic growth and progress, those gains should not be achieved at the expense of the environment. Most people advocate the existence of a moral obligation towards future generations driven by altruism, particularly because decisions taken today may affect the well-being of people living in the next generation, which will be inherited by the next-next generation, and so on. Intergenerational equity represents therefore a key concept for sustainable development as inequalities among different generations may be translated into environmental degradation.

Discounting is at the heart of any intergenerational problems and has long been a contentious issue for the evaluation of public investments in cost-benefit analysis (CBA). Decades of debate over the choice of the social discount rate (SDR) – i.e., the rate at which society evaluates current *versus* future well-being – show how discounting is crucial for CBA and resource allocations. This has in fact important implications not only over the choice of a specific project (*ex ante*), but also over the evaluation of its performance (*ex post*).

Economists have proposed several alternative methods and rationales for the choice of the discount rate to be used in CBA. It can be argued that the contribution of behavioural economics here is certainly not negligible. Over time, laboratory experiments have provided different and conflicting psychological and sociological explanations for discounting. In general, empirical evidence suggests that when facing intertemporal choices individuals' behaviour departs from that predicted by rational economic models and many other factors influence people' evaluation of future outcomes, that is: a *strong desire or present bias* (Frederick et al., 2002) to receive gains immediately which leads to greater discount rates (per unit of time) for short delays (also known as *hyperbolic discounting*) rather than long ones; the *magnitude effect* for which individuals discount less large magnitude outcomes (see for example Thaler, 1981, and Chapman and Elstein, 1995); the *sign effect* that implies people discount losses less than gains (see Thaler, 1981); and the *delay effect* for which people discount more when they have to receive something immediately and discount less the same things when they have to get them later. This not only has suggested departures from orthodox theoretical arguments, but it has also incentivized economists to (re) model their analyses according to the above-described behavioural anomalies.

Despite the differences among these approaches, in the past it was possible to achieve temporary consensuses over the variety of values and methods to obtain appropriate discount rates. However, the recent Stern Review (Stern, 2007) has added new impetus to this debate. The purpose of this chapter is to provide a survey of the vast existing literature on intergenerational equity and discounting and to link this to behavioural economics and environmental morale. In particular, the rest of the chapter attempts to provide answers to the following questions<sup>114</sup>:

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<sup>114</sup> There have been many surveys in the literature on these topics. However, not many look at all these aspects simultaneously. Zhuang et al. (2007), e.g, provide a survey on different approaches to the choice of the social discount rate. Tóth (2000) and Scarborough (2011) analyze aspects related to intergenerational equity and discounting. Finally, Brekke and Johansson-Stenman (2008) show the potential and current contributions of behavioural economics to environmental economics, while Frederick et al. (2002) critically evaluate behavioural anomalies on intertemporal choices emerging from the laboratory.

- 1) What are the arguments in support of the different analytical approach to obtain an appropriate (social) discount rate?
- 2) How intergenerational equity problems can be modelled in CBA?
- 3) What are the contributions of behavioural economics in this area of research?
- 4) Can environmental morale play a role in discounting?

To this end, Section 5.2 briefly describes a basic framework of cost-benefit analysis showing the relevance of discounting for project evaluation. Section 5.3 provides a detailed overview of the origin of the discounting dilemma. Section 5.4 and 5.5 critically evaluate the different approaches used in the literature to choose ‘suitable’ and/or ‘correct’ social discount rates aimed at intergenerational equity and sustainable development goals. Section 5.6 addresses the relevance of discounting for modelling intertemporal problems and provides a review of advantages and disadvantages of using infinite-lived agents (ILA) *versus* overlapping generations (OLG) models. Finally, Section 5.7 analyses recent contributions of behavioural economics to understanding individuals’ time preference over different intertemporal choices and commodities. Overall remarks are reported in section 5.8.

## 5.2 CBA AND DISCOUNTING: A BASIC FRAMEWORK

Among other methodologies (e.g. contingent valuation, CV), cost-benefit analysis (CBA) represents a way to integrate environmental costs and benefits into development decisions. CBA is generally considered as an abstraction of the discounted-utility model formalized by Paul Samuelson (Samuelson, 1937) and pioneered by Ramsey (1928) in his seminal paper ‘A mathematical theory of savings’<sup>115</sup>. This approach is based on the idea that future costs and benefits of a particular project need to be discounted to the present. If the resulting net present value (NPV) of the project is greater than (or at least equal to) zero, the CBA suggests implementing the project. Formally, the net present value can be calculated as follows:

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<sup>115</sup> It is generally agreed in the literature that Samuelson (1937) provided the first contribution to the theory of discounted-utility (DU) models. However, it has to be noted that preliminary insights into the framework of DU models can also be found in the Ramsey’s growth model (1928).

$$NPV = \sum_{t=0}^T \frac{(B_t - C_t)}{(1+r)^t}, \quad (5.1)$$

where  $(B_t - C_t)$  represents net benefits (i.e. benefits net of costs) at time  $t$ ,  $(1/(1+r)^t)$  is the discount factor with  $r$  equals to the discount rate (expressed in real terms), and  $t$  is the time index. Equation (5.1) shows that the efficiency<sup>116</sup> of CBA strongly depends on the level of the discount rate (and the calculation and inclusion of all tangible /monetary and intangible/non-monetary costs and benefits into the analysis)<sup>117</sup>. In particular, a high discount rate might preclude many desirable projects to be undertaken. By contrast, a very low discount rate can lead inefficient projects to pass the CBA test.

In general, an effective social discount rate should be able to reflect how people substitute consumption in the current period with consumption in the following periods, and it should be able to deal with the allocation of resources between private and public sectors<sup>118</sup>. The first argument is based on the idea that individuals (i.e., savers) are willing to trade off current with future consumption if current sacrifices (or saving) are compensated more than proportionally in future times. This is because assuming consumption increases over time, individuals' marginal utility of future consumption decreases. Furthermore, many economists have made the assumption that individuals have a positive pure rate of time preference, that is, an immediate pleasure is always preferred to one experienced in the future. There are at least two psychological aspects to justify the pure time preference assumption: one is individuals' impatience (or myopia), the second one is related to individuals' fear of not being alive in the far distant future<sup>119</sup>. This gives rise to what is generally known in the literature as the social rate of time preference (SRTP) – i.e., the rate at which individuals are willing to trade a unit of current consumption with more than a unit of

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<sup>116</sup> Economic efficiency requires that the social discount rate is equivalent to the marginal social opportunity cost of funds allocated to public investments. See Portney and Weyant (1999) for a discussion on differences between equity and efficiency.

<sup>117</sup> For the purpose of this analysis only the problems related to the level of the social discount rate (SDR) and intergenerational equity will be discussed. For a discussion about the evaluation of tangible/intangible costs and benefits in environmental contexts, see for example Goodin (1982), Markandya and Pearce (1991).

<sup>118</sup> For a detailed discussion on these topics, see Zhuang et al. (2007) and Cullis and Jones (2009).

<sup>119</sup> For society this risk can be associated to an exogenous risk of calamity eliminating society (see for example Dasgupta and Heal, 1980, Rees, 2003).



future consumption. In general, the rate of return on investments is considered as a maximum value for the social rate of time preference (see Lind, 1982, Arrow et al., 1996, and Pannell and Schilizzi, 2006).

The second argument is based on the assumption that in order to persuade a producer (i.e., investor) to invest in a public project, the amount the project must make should be at least as high as the opportunity cost of funding – i.e., the choice of a public project is justified if and only if there are no alternative investments in the private sector that would have led to a greater rate of return. According to these lines of reasoning, the rate of return an investor should use in discounting benefits and costs of a project should equal the social opportunity cost rate of discounting (SOC), which can provide an index of the value of the investment in its best alternative use. In general, the market interest rate represents the minimum rate required to obtain a safe investment<sup>120</sup>. The idea is that, likewise in the financial market, if individuals want to maximize their benefits (for the future), they chose a safe investment if and only if the interest rate generated by the project is greater than the internal rate of return of the project. A lower discount rate than that used in the financial market would be against the interest of future generations since it would deviate capital from higher to lower return investments (based on the arbitrage argument).

The SRTP and the SOC represent respectively the supply and demand prices in a standard model of investible funds. It is commonly agreed in the literature that in an ideal world without distortions (e.g. externalities, unemployment, and suboptimal taxation) the market clears at an interest rate that equals the social rate of time preference and the social opportunity cost to the rate of return on capital. In other words, all conditions for an ‘optimal’ social discount rate are satisfied. However, in reality, markets are not perfectly competitive and distortions impose a wedge between the SRTP and SOC, with the social rate of time preference being usually lower than that of the SOC. Under these circumstances, costs and benefits with different time profiles cannot be compared. In addition, given that a single rate of return does not satisfy both requirements, this raises the question of which is the best discount rate to be used for CBA. A general accepted rule of thumb is to use a lower

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<sup>120</sup> For a discussion see Gollier (2011).

discount rate than that observed in the market if emphasis is laid on the allocation of resources through time. The opposite is true for those who put emphasis on current allocation of resources in the public and private sector.

The following sections provide a review of different approaches suggested in the literature in order to obtain efficient evaluations for long-term projects. Issues related to intergenerational equity will be addressed and introduced into the analysis.

### **5.3        DISCOUNTING        ENVIRONMENTAL        ASSETS: INTERGENERATIONAL EQUITY AND SUSTAINABILITY**

#### ***5.3.1 SOC versus SRTP***

Attention to discounting started during the 90s when public policy debates raised the question of what kind of discount rate had to be used to calculate the NPV of costs and benefits of specific investment projects. The origins of the debate can be traced to Eckstein (1958) who devoted his book to the development of cost-benefit analyses for the water sector in the United States. However, other events such as the great oil crisis in 1973 forced the United States and other countries in the world to consider other sources of energy supply, which entailed the evaluation of a number of upfront investments. In 1977 many economists and politicians with the support of the Electric Power Research Institute (EPRI), Resources for the Future (RFF) convened a conference to discuss the discount rate at which these investments had to be evaluated. A few years later these contributions were collected together and revised to provide a published book by Lind (1982). The main issue discussed on that occasion relates to the numeraires used for discounting in cost-benefit analysis. The dispute was mainly focussed on the employment of the opportunity cost of capital (which reflects the private marginal productivity of capital), or the consumption rate of interest (which provides a measure of the individuals' rate of time preference) as possible candidates to obtaining 'suitable' and/or 'correct' social discount rates.

The former is generally identified with the real risk-free market interest rate (i.e. market-based discount rate)<sup>121</sup>. Among the reasons supporting the adoption of the social opportunity cost of capital as a numeraire for the social discount rate, many authors suggest that resources are scarce, and that public investments displace private investments, which can provide a better alternative use of the same funds (examples are Baumol, 1968, and Diamond and Mirrlees, 1971). This justifies the assumption that ‘public investments should yield at least the same return as private investment. If not, social welfare can be increased by reallocating resources to the private sector’ where it would be possible to obtain higher returns (see Zhuang et al., 2007, p. 9). However, there are many arguments against the employment of the SOC as the appropriate social discount rate. Dasgupta et al. (1972), for example, suggest that the opportunity cost of capital can only be applicable when considering fixed capital (irrespective of the project choice – i.e., public *versus* private) in a two-period model. When one of these assumptions is relaxed, the rate of return on investments no longer represents an adequate measure of the social discount rate. Assuming individuals postpone their current consumption (i.e. save more) when public projects are financed, in fact, the return required by consumers will be lower than that suggested by the SOC.

Some authors also argue that given market imperfections (i.e. market externalities), market prices do not reflect the true opportunity cost (i.e. *shadow price*) of resources invested today (see for example Drèze and Stern, 1990, Broome, 1992, and Hepburn and Koundouri, 2007). In addition, Hepburn (2006) suggests at least three other arguments for the inappropriateness of simply using the SOC discount rate: the super-responsibility of governments (based on the idea that market prices might reveal only preferences of the current generation, therefore governments – being liable for both the current and the future generations – should not rely only on market information); the dual-role of politicians (politicians might be more concerned about future generations with respect of what current activities in current market would reveal); and the isolation argument (individuals may be more willing to save in a collective contract than in isolation). Finally, other scholars question the validity of the social opportunity cost discount rate given the difficulty in weighting

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<sup>121</sup> The use of the risk free rate of return has been supported by Samuelson (1965), and Arrow (1966) among others.

different sources of capital, which would lead the true opportunity cost of capital to vary across a variety of sectors (see e.g. Henderson and Bateman, 1995, Scarborough, 2011).

The consumption rate of interest, which is also known in the literature as the social rate of time preference (SRTP), relates to the rate at which the society is willing to trade current consumption with future consumption. Generally the SRTP is represented by the following relation, noted in (Gollier, 2011) – i.e., Ramsey equation (Ramsey, 1928):

$$r = \delta + \gamma g, \quad (5.2)$$

where  $\delta$  is the pure rate of time preference (or utility discount rate),  $g$  is the annual growth rate of per capita consumption and  $\gamma$  represents the elasticity of the marginal utility of consumption. The first term of the right hand side reflects the rate of impatience – i.e., the rate at which individuals prefer present consumption to future consumption (accounting for impatience and exogenous risks of natural calamities)<sup>122</sup>. The second term of the right hand side represents the ‘*wealth-effect*’ and reflects the decreasing marginal utility principle. In other words, the component  $\gamma g$  reveals that since it is likely that future generations will be richer (assuming the economy grows at a certain rate  $g$ ), less weight need to be attached to them. Although it is important to acknowledge that both the utility discount rate and the elasticity of marginal utility of consumption are difficult to estimate (see Scarborough, 2011), the social rate of time preference seems to be more appropriate to directly take into account intergenerational equity problems. First, the pure rate of time preference offers a direct measure of how people trade off current versus future consumption. Second, as suggested by Garnaut (2008, cited by Scarborough, 2011, p. 148) the marginal utility of consumption represents a measure of “society concern for equity in income distribution”.

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<sup>122</sup> In its original formulation Ramsey (1928) argued that the appropriate value of pure time preference should be equal to zero, based on the assumption that all individuals, including those living in future generations, should be treated equal. However, other economists proposed a positive rate of pure time preference given that assuming it is equal to zero would generate many sacrifices to the current generation for the sake of future ones (for a detailed discussion see Koopmans, 1960, Olson and Bailey, 1981, Cline, 1992, Arrow et al., 1996).

However, as stated by many authors (see for example Hepburn, 2006, Hepburn and Koundouri, 2007, Scarborough, 2011) this does not mean that the private interest rates are completely irrelevant. One of the major criticisms on using the SRTP as the social discount rate is in fact that (as a measure of the social opportunity cost of the forgone consumption) it completely ignores the idea that public investments displace private investments when the market interest rate rises (see Zhuang et al., 2007 for a discussion). However, if this is the case, the market interest rate will be the opportunity cost of those investments. Furthermore, as mentioned above, others point out that since the SRTP is lower than the SOC, this raises the problem that many low-return investments would be undertaken at the expense of more profitable private ones.

There have been many attempts in the literature to reconcile the SRTP and SOC approaches<sup>123</sup>. Among them, Lind (1982) developed a framework that during the 1980s became the dominant discounting technique for CBA. His model is based on the concept of the shadow price of capital (SPC)<sup>124</sup>. This approach recognizes that while the costs of a public investment may crowd out private investments, its benefits can be reinvested into the private sector. In order to take into account the effect of public investments on private capital formation, Lind (1982, p.39) suggested to convert all costs and benefits that either displace or generate private investment into consumption equivalents by multiplying them by the shadow price of capital (i.e., “the present value of the future stream of consumption benefits associated with 1\$ of private investment discounted at the social rate of time preference” – with a positive pure rate of time preference).

### ***5.3.2 Lower discount rates for long-run projects***

Despite the Lind’s approach for fifteen years was able to create agreements on the dispute about the rate of discounting to be used for CBA, many authors (Lyon, 1990,

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<sup>123</sup> Haveman (1969), among others (see e.g. Harberger, 1972; and Burgess, 1988), suggested for example to employ a weighted average approach (WA) – i.e., using a mixture of both discount rates by weighting them according to the proportion in which each components (i.e. consumption and private investment) finance the investment. See Zhuang et al. (2007) for a detailed discussion on this approach.

<sup>124</sup> In this context, previous contributions are e.g. those provided by Feldstein (1972) and Bradford (1975).

Nordhaus, 1994, and Jenkins et al., 1997) criticized this approach given the difficulties related to its implementation. Practical obstacles arise, in fact, from the need to incorporate into the calculation of the social discount rate information about several parameters (i.e. SOC, SRTP, rates of depreciation and reinvestment, marginal rate of taxation on capital income and the marginal propensity to save) to which the SPC is very sensitive. In addition, the growing concern for global warming and climate change (as well as other environmental problems e.g. the preservation of biodiversity) led many scientists, environmentalists, and politicians to question the validity of CBA for the evaluation of long-term projects and opened a new debate about the numerical value to attach to the discount rate. The CBA technique, in fact, tends to reduce the values of costs and benefits in the distant future, thus ‘playing against’ future generations. A simple example might help to clarify the problem at hand. Assuming a constant discount rate over time, if the discount rate is equal to 3%, the present value of 100 pounds one year from now will be approximately 97.1 pounds. However, the net present value of 100 pounds in 200 years will be 0.27 pence, which becomes a negligible amount of money when considering a time span of 500 years. Therefore, specific effects (e.g. distributional effect) of a project can be ignored when considering long-run projects.

In general, it is common practice for economists to separate efficiency from equity considerations when evaluating a particular policy<sup>125</sup>. As suggested by Hepburn (2006), in fact, the government can use the tax system to redistribute income across agents. However, for climate policy, distributional considerations are crucial as there is not an intergenerational tax system for wealth redistribution. Thus, “a policy action may be unattractive on distributional ground even if it passes the efficiency test” (Portney and Weyant, 1999, p. 6)<sup>126</sup>. As a matter of fact, in a few years the existing debate about the ‘correct’ foundation of the social discount rate was replaced by the controversy about intergenerational equity.

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<sup>125</sup> Efficiency evaluation is based on the Kaldor-Hicks criterion – i.e., an efficient project is one that when undertaken guarantees to the beneficiaries of the projects to gain more than the losers will lose due to the forgone consumption of the involved resources.

<sup>126</sup> Possible other limitations of CBA in the context of climate change are the lack of consideration of ‘ethical’ aspects into projects’ evaluation (e.g. liberty and rights) and its inappropriateness to analyse large scale changes in climate policy. For a discussion see Hepburn (2006).

These issues were initially discussed during the Intergovernmental Panel on Climate Change (IPCC) in 1995 and once again collected in a report (IPCC, 1996). Arrow et al. (1996) devoted a chapter of the report to discounting and intergenerational equity and recognized the existence of two different schools of thought about discounting: one following a *prescriptive* approach, the other one based on a *descriptive* approach. The former advocates the use of a constant discount rate evaluated according to the Ramsey rule and lower than that observed in the financial market. In particular, given ‘ethical’ concerns it assumes that discounting should take into account the well-being of future generations. The latter predicts that the discount rate should be set to the rate of return on capital computed in a variety of alternative assets (i.e., marked-based rate).

Given these considerations it seems not surprising that, by the end of the nineties, the apparent consensus on discounting was no longer held and different approaches proposed different discount rates for CBA. Under these circumstances, the RFF organized a new conference where the focus and motivation of the discussion were the implications of climate change on future generations. The main conclusions were collected and published by Portney and Weyant (1999) and were generalized to all intergenerational policy decisions<sup>127</sup>. Almost all participants suggested (with one exception)<sup>128</sup> adopting a *descriptive* approach for short to mid-term projects (40 years or less). However, no consensus was reached about how to discount projects under longer time horizons. A possible solution supported by a minority of participants was in favour of the *prescriptive* approach, thus suggesting choosing a lower discount rate than that reflecting the opportunity cost of capital<sup>129</sup>. The rationale for this was to avoid the so-called ‘tyranny of the present’ (see Koundouri, 2009, for a discussion)<sup>130</sup>, which, according to cost-benefit analyses, would assign higher priority to programs yielding immediate benefits (or distant costs) if compared to those that may arise a century hence (or immediately).

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<sup>127</sup> For an overview of the contributions to the workshop see Tóth (2000).

<sup>128</sup> For a detailed discussion see Dasgupta et al. (1999) who envision a zero discount rate or even a negative one.

<sup>129</sup> See for example Cline (1999) and Nordhaus (1999).

<sup>130</sup> The term was coined in the Copenhagen Consensus in 2004 (for a report on its conclusions see Lomborg, 2004).

Despite these considerations, the application of a constant reduced discount rate for long-term projects was also not immune from criticisms (see for example Lind, 1997, Neumayer, 1999, Padilla, 2002). Philibert (1999) for example mentions several reasons why a lower discount rate cannot be suitable for future generations' well-being<sup>131</sup>. Among them, the major concern regards the idea that modifying the standard discount rate can equivalently be translated as asking for more sacrifices to the current generation, which should consume less and save more for future generations (presumably richer than the present one).

Padilla (2002, p. 70) states that “there is not a unique relationship between discounting and environmental degradation”. Following Pearce and Turner's (1990) point of view, the author points out that the risk related to a low environmental discount rate is that if this is spread out on global investments, it could be translated into an increase of capital investments. Therefore, in the long run this will reduce the level of natural resources and will increase environmental degradation, albeit future generations would inherit higher capital endowments. Further concerns are also related to the arbitrary choice of a low discount rate that can remove efficiency and adjust the rate of discounting to what has been previously decided without any scientific rigour (Padilla, 2002). In addition, an arbitrary extension of time preferences of current generations beyond their life span lead to inequity considerations, especially if the choice of the discount rate is based on future generations' prosperity. Indeed, this is translated to assigning a very low weight to future generations (i.e., *optimistic paradox*). Finally, the author questions the assumption that altruistic preferences guarantee that the interests of future descendants are appropriately considered, given that “the unborn have neither political power nor representatives” (ibid, p. 70).

By contrast, Sáez and Requena (2007, p. 716) believe that “a rational planning of the future cannot be based on the application of discount rates that govern all

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<sup>131</sup> The author provides arguments against the general reasons in support of a low discount rate. In particular, he confutes the hypothesis that the social rate of time preference dominates the marginal rate of return on private investments given that they are interdependent. The ‘*isolation paradox*’ (for a detailed discussion see Philibert, 1998) supports the conclusion that even if individuals cannot express their real preferences regarding future generations (because they are isolated by markets), this does not necessarily mean that we should consider choosing a low rate of discounting. Finally, arguments favouring a non-zero pure rate of time preference are provided.



activities, project and resources”. However, *ad hoc* adjustments – e.g., for forestry projects – may be a “rational variant within an irrational procedure” (ibid).

## **5.4 EARLY RESOLUTIONS TO THE DISCOUNTING DILEMMA**

### ***5.4.1 Abandoning discounting***

Early resolutions to the discounting dilemma involved four different views about discounting and long-term intergenerational trade-offs. The first view suggests abandoning discounting, thus providing different approaches to evaluate the future. Schelling (1995), for example, proposes a ‘utility function approach’ where policy makers critically evaluate a menu of climate change mitigation projects by calculating the utility increase in different region at different time. This approach has the appeal of posing importance on weights of consumption flows (and not on discounting) in different periods of time. Kopp and Portney (1999) introduce voting mechanisms. In this context, a random sample of the population is presented with different policy effects across time and space. Respondents would then vote for or against the policy being implemented. Their answers can then be used to estimate respondents’ willingness to pay for the policy. This approach has the merit of valuing the future by asking citizens directly to state their actual discount rate, rather than trying to infer it by evaluating their attitudes and behaviours. Indeed, there have been many attempts in the literature to infer how people trade-off current vs. future well-being and/or consumption. In several surveys and laboratory experiments, individuals, in fact, have been asked to state their opinion regarding a change applying in the future (for a survey see Frederick et al., 2002). However, given that the majority of them consider a short time horizon, it is not possible to make any conclusions at intergenerational scale. However, it has to be noted that the most critical aspect of voting-mechanisms is that they rely on stated preferences and they are therefore subject to possible biases related to this methodology (e.g. hypothetical bias).

### 5.4.2 Intergenerational CBA

Other approaches advocate the inclusion of intergenerational equity considerations into the analysis (i.e., intergenerational CBA). This methodology, pioneered by Kula (1988) who first introduced the idea<sup>132</sup>, suggests the application of intergenerational distributional weights in CBA as a measure of an individual level of distributional preferences. Recent contributions to this area of research have been provided by Padilla (2001) and Padilla and Pascual (2002) who introduced the concept of ‘Multigenerational Net Present Value’ (MNPV), based on the inclusion of individuals’ level of ‘altruism’ into social intergenerational weighting<sup>133</sup>. Looking at equation (5.1), the net present value formally changes in the following way:

$$NPV = \sum_{t=0}^T \varphi \frac{(B_t - C_t)}{(1+r)^t}, \quad (5.3)$$

where  $\varphi$  represents the distributional weight that needs to be attached to different generations. From a theoretical point of view this approach has been considered very attractive. However, controversies arise from the assignments of the ‘correct’ weights (based on subjective judgement) that represent the preferences upon intergenerational altruism of society towards future generations. In this context, recent contributions have been provided by Scarborough (2011) who, as an example, illustrates feasible (but not definitive) equity-adjusted discount rates based on community distributional preferences elicited in Scarborough and Bennet (2008). The estimated intergenerational weights that emerge from the study are 1.4 and 1.6 over the same generation (depending on age differences), and 2.2 over two generations<sup>134</sup>.

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<sup>132</sup> The modified discount method introduced by Kula (1988) first considers discounting each generation’s consumption flows at the social rate of time preference and then obtains the net present value of the project by adding them. However, this approach assigns each generation the same weight, which implies ignoring differences in preferences for the components of current society (for a discussion see Padilla, 2002).

<sup>133</sup> With a similar rationale Sumaila and Walters (2005) introduce the concept of ‘Intergenerational Discount Factor’.

<sup>134</sup> A generation is defined over 25 years.

Intergenerational CBA is certainly an interesting line of research for long-term projects' evaluation. A possible advantage of adjusting for intergenerational equity weights is that it can help solve the dispute on the 'correct' social discount rate needed for cost benefit analysis (i.e., SRTP vs. SOC). If this approach is adopted, in fact, it seems reasonable to employ the social opportunity cost of capital method to estimate the SDR (for a discussion see Randall, 2006, and Scarborough, 2011). As suggested by Scarborough (2011, p. 155), this can "circumvent possible double counting of time preferences and intertemporal marginal utility associated with incorporating intergenerational equity adjustments to a consumption-based social discount rate". However, in this area further research is needed to analyse individuals' preferences towards intergenerational distributional weights and their interaction with the social discount rate.

#### 5.4.3 The K-F approach

A third view suggests to employ the traditional social discount rate, but to increase the value of the environmental assets over time. This is known in the literature as the Krutilla and Fisher (see Krutilla and Fisher, 1975, and Fisher and Krutilla, 1985) approach (i.e., K-F approach). The rationale behind this methodology is that as natural resources are likely to decrease over time, individuals' willingness to pay both for the benefits and costs – of goods' protection and extinction, respectively – increases, thus leading the value of environmental goods to be incredibly expensive with time<sup>135</sup>. A formal representation of the K-F model can be given as follows:

$$NPV = \sum_{t=0}^T \left( \frac{(B_t - C_t)}{(1+r)^t} \right) + \sum_{t=0}^T \left( \frac{(EB_t - EC_t)}{(1+r)^t} \right), \quad (5.4)$$

where equation (5.4) differs from equation (5.1) in that it includes the value of the environmental good, which increases at different points in time.

The K-F approach advises the use of a 'net discount rate' lower than that reflecting the opportunity cost of capital to discount environmental costs and

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<sup>135</sup> For similar arguments see for example Tol (1994), Arrow et al. (1996), Hasselmann (1999), Philibert (1999), and Horowitz (2002).

benefits. This net rate is constant over time and captures the expected variation of the values of the environmental good (i.e. the individuals' willingness to pay for benefits and costs at time  $t$ ), as a result of its decreasing supply<sup>136</sup>. For this reason the K-F approach has been sometimes misinterpreted as if it would apply 'dual-discount rates' (as argued Padilla, 2001, Sáez and Requena, 2007, and Almansa and Martínez-Paz, 2011)<sup>137</sup>, which will be discussed further below. Although the K-F approach has been criticized on a number of grounds (for a detailed discussion, see Groom et al., 2005), according to Horowitz (2002) the real problem here is determining individuals' future willingness to pay for environmental goods.

#### ***5.4.4 Declining Discount Rate (DDR)***

The most convincing approach emerging from earlier literature is the adoption of a declining discount rate (DDR) over time. So far, irrespective of the level of the discount rate, a common denominator for all eligible candidates as discount rates was that, across the time horizon, all adjacent time periods had to be weighted at a constant rate, i.e. all investments need to be discounted exponentially. However, over the last couple of decades, economists recognized the importance of declining discount rate for intergenerational equity and efficiency (see Hepburn, 2006). In general declining discount rates seem to reflect preferences for intertemporal choices, pessimistic views about the future, concerns on future uncertainty and intergenerational equity. Each of these aspects is briefly discussed below.

##### ***5.4.4.1 Intertemporal choices***

There is large evidence in the behavioural economic literature of humans' use of declining discount rates for intertemporal choices. Researchers usually ask individuals to choose between a set of different delayed outcomes (e.g. money, durable goods, and number of lives saved by particular projects) in order to construct the implicit functional form for their responses. In general, results show that subjects discount at higher rates present rewards and tend to trade-off future outcomes at a

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<sup>136</sup> In particular, the willingness to pay increases at a pre-determined rate to which the conventional social discount rate (i.e. the market-based interest rate) is reduced.

<sup>137</sup> See for example Groom et al. (2005).

lower discount rate. Although there have been different functional proposals for declining discount rates<sup>138</sup>, much of the evidence and theoretical studies provided in the literature supports a hyperbolic functional form<sup>139</sup>. This might explain why declining discount rates are commonly referred in the literature as hyperbolic discounting<sup>140</sup>, thus creating some confusion about the adoption of the two terms<sup>141</sup>.

#### ***5.4.4.2 Pessimism about the future***

As suggested by many authors, pessimism about the future can lead to the employment of a declining discount rate (see for example Dasgupta, 2001, Groom et al. 2005, and Hepburn, 2006). As stated above, in a deterministic world without distortions the SRTP is equal to the private and social rate of return on capital. However, as shown in equation (5.2), the social discount rate is a function of consumption growth. Therefore, other things being equal (i.e. assuming the utility discount rate and the elasticity of the marginal utility of consumption as constants), if the consumption growth rate declines over time, it follows from (5.2) that the SDR also declines through time.

In general, in an optimal growth model with productive capital, declines in consumption rates seem to be impossible. However, Weitzman (1994) provides a theoretical explanation for declining discount rates. The author points out that the

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<sup>138</sup> Weitzman (2001), for example, introduces the concept of ‘gamma discounting’ as a result of a survey based on economists’ opinion into the current debate about global warming. The author concludes that society should employ a discount rate declining over time (following a gamma distribution) from an average rate of 4 per cent in the immediate future (i.e. 1-5 years) to zero per cent for the far distant future (i.e. more than 300 years). Alternatively, Springmann (2010) suggests a sinusoidal discount function that expresses the discount rate as a harmonic function (i.e. cosine function). This approach is characterized by a standard discount schedule in the short run (i.e. 30-40 years), and a peak in the long run (where the peak is interpreted as a period of no returns or investments). The novel approach is used then as a comparison with the current European Commission schedule and the stepwise declining discount rates adopted by the UK government to analyse the impact of a forest conservation project and a nuclear power project. The author concludes that in both cases the adoption of a sinusoidal discount rate better captures concerns for sustainability, intergenerational equity and risk and uncertainty related to far distant future problems.

<sup>139</sup> See for example Thaler (1981), Cropper et al. (1994), Kirby (1997), Henderson and Bateman (1995), and Harris and Laibson (2001). For a review see also Ainslie (1992), Frederick et al. (2002) and Loewenstein et al. (2003).

<sup>140</sup> The discount factor,  $DF$ , for hyperbolic discounting can be generally expressed as  $DF = (1/(1+at))$ , where  $a$  represents the applied discount rate and  $t$  is the size of delay (typically in years).

<sup>141</sup> On these grounds, Rasmusen (2008) offers clarifications over the meaning of ‘hyperbolic discounting’ and declining discount rates.

existence of consumption goods externalities tend to create a tension between private and public investments if individuals value environmental resources positively. This tension generates a wedge between the private and social rate of return, thus suggesting choosing a SDR lower than that of the private sector. However, if the proportion of income spent on environmental goods is increasing over time<sup>142</sup>, the efficient rate of discounting should be declining over time (see Groome et al, 2005). In a similar way, Azar and Sterner (1996), analysing the relationship between discounting and global warming, suggest abandoning exponential discounting to use a lower discount rate (than that used in the private sector) declining over time.

#### ***5.4.4.3 Uncertainty***

According to Weitzman (1998) near and far distant future should be treated differently given the uncertainty involved in economic evaluation several decades into the future. Weitzman (1999, p. 29) writes “While there is uncertainty about almost everything in the deep future, perhaps the most fundamental uncertainty of all concerns the discount rate itself. As seen from today, the deep-future interest rate is a true random variable for all of the reasons that make the far-distant productivity of capital uncertain”. Given the variety of possible discount rates that can be used to evaluate the far distant future and the lack of certainty about the values to be attached to the discount rates (i.e. rate of return on capital), the author develops the notion of ‘certain-equivalent discount rates’ as a possible solution to this dilemma. Rather than averaging the discount rates, according to Weitzman (1998, 1999), what should be averaged is the probabilistic discount factor. The certain-equivalent discount rate is then derived from the weighted average of all feasible discount factors.<sup>143</sup> In the long-run, this leads to the adoption of the lowest available rate having any positive probability of occurrence. The key assumptions behind the Weitzman-model are that the discount rates are uncertain and interrelated from one period to another. If these assumptions hold, intergenerational efficiency requires declining discount rates.

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<sup>142</sup> This conclusion comes from the idea that environmental damages must be maintained at some initial standard. This can only be guaranteed by a marginal increase of environmental expenditures, diverted from each unit increase of output.

<sup>143</sup> This is because according to Weitzman (1998, 1999) the discount rate should not be considered as a time-independent constant.

Gollier (2002a, 2002b) provides a more solid justification for a declining discount rate (under uncertainty) by analysing a specific optimal growth model and characterizing certain types of utility functions, which allow specifying the term structure of the socially efficient discount rates. Gollier (2002a, 2002b) concludes that declining discount rates can be justified by the *prudence effect* (see Kimball, 1990), which leads to a negative precautionary effect – i.e., given uncertainty about future consumption, individuals tend to save more for the future, thus reducing the discount rate<sup>144</sup>. Therefore, declining discounting occurs either if the *wealth effect* decreases more than proportionally, or if the precautionary effect increases more than proportionally over time.

In a series of papers, Gollier (2004, 2009a, 2009b) criticises the Weitzman-approach, leading to what is known in the literature as the Weitzmann-Gollier puzzle<sup>145</sup>. The author questions the validity of the assumptions of the Weitzman-approach, and starting from the same initial conditions reaches different conclusions – i.e., the term structure of the social efficient discount rate can either increase over time to its largest value, or can be flat. This is mainly due to the fact that the Weitzman’s results strongly rely on the assumption that shocks on the rate of return on capital are permanent. However, in a recent contribution, the puzzle is resolved. Considering an optimal consumption path model, Gollier and Weitzman (2010) show, in fact, that the efficient discount rate obtained by solving the maximization problem at hand resembles closely that suggested by Weitzman. The only difference lies on the replacement of the unadjusted probabilities with the ‘Weitzman-adjusted’ ones (developed in the model)<sup>146</sup>. Under these conditions, declining discounting still

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<sup>144</sup> Formally, the social discount rate in equation (5.2) needs to be modified to account for the *prudence effect* – i.e.,  $r = \delta + \gamma g - 1/2\gamma P \text{var}(g)$ , where  $P$  measures the prudence effect, and  $\text{var}(g)$  is the variance of consumption growth.

<sup>145</sup> For a discussion see also Buchholz and Schumacher (2008), and Freeman (2009).

<sup>146</sup> In the model, Gollier and Weitzman (2010) state that critical aspects of their analysis are the timing sequence of information availability, and that of making decisions. Solving a maximization problem, the authors show that the obtained optimal discount rate is similar to one previously defined in the literature (i.e., Weitzman, 1998, and Gollier 2004, 2009a, 2009b) up to a risk adjustment of probabilities (over the realization of an uncertain future discount rate). On the one hand, Weitzman converts cash flows into consumption and adjusts the NPVs with units of marginal utility at time 0. On the other hand, Gollier makes these adjustments at time  $t$ . However, under the first-order condition developed in the model, the authors show that the two approaches coincide. Therefore, they conclude that the adjustment of the valuation of risk solves the puzzle and suggests using a declining discount rate.

holds when future discount rates are uncertain and shocks on capital productivity (and risk on consumption growth) are permanent.

#### ***5.4.4.4 Intergenerational equity***

The importance of declining discounting has also been strengthened for intergenerational equity considerations. Chichilnisky (1996, 1997) first introduces two axioms for sustainable development and shows that declining discounting is consistent with the ‘non-dictatorship’ of one generation over another<sup>147</sup>. These axioms require that the ranking of alternative consumption paths is sensitive both to what happens in the present and immediate future, and in the very long run. Sensitivity to the present means that there is no date before which events are assigned zero weights. Sensitivity to the future means that there is no date after which changes (in consumption) do not matter for the ranking<sup>148</sup>. In a recent work Chichilnisky (2009) shows that these axioms are equivalent to awareness of extinction problems in the long-run future. In particular, the author proves that maximizing a DU model with a long-run survival constraint is equivalent to maximizing utilities where the present and the future are equally treated. The equal treatment axioms can guarantee therefore sustainable development.

Li and Löfgren (2000) provide also similar conclusions. They analyse a model where society consists of two individuals: one is conservationist and the other one is utilitarian. Individuals have the same utility function but employ different discount rates – i.e. the utilitarian has a rate of time preference positive and constant over time, while the conservationist has a rate of time preference equal to zero. The objective of the policy maker is to maximize a weighted sum of the well-being of both individuals. The authors conclude that within this framework the conservationist dominates the far distant future and suggest the adoption of a discount rate declining over time towards zero.

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<sup>147</sup> Heal (2003) shows that the Chichilnisky criterion has no resolution under exponential discounting.

<sup>148</sup> For a discussion see also Groom et al. (2005), and Rambaud and Torrecillas (2006).



#### 5.4.4.5 Limitations to the DDR approach

As with other approaches declining discounting has been criticized on several grounds. As suggested by Groom et al. (2005) and Hepburn (2006), some authors provide different interpretations for laboratory evidence. Read (2001) argues for example that the so-called evidence for hyperbolic discounting is in fact evidence for *sub-additive* discounting – i.e., given that discounting depends on the size of the time delay, discounting is greater when the delay is divided in subintervals. In other words, the discount rate of an outcome to be received in a century tends to be smaller than the total discount rate obtained by adding the separate discount rates of a century divided into decades or years. This has important implications for theories of intertemporal choice. Supporters of hyperbolic discounting, in fact, attribute individuals' declining impatience to delay, thus confounding delay “(the period between the present and when an outcome occurs) with the interval between two outcomes” (ibid, p.6). However, *sub-additive* discounting relates it to the inter-outcome intervals<sup>149</sup>.

In the same vein, Rubinstein (2003) questions the interpretation of laboratory experiments on hyperbolic discounting and explains that his own reading of the experimental results is consistent with *similarity relations* (as described in Rubinstein, 1988) – i.e., when making their decisions, individuals ignore small differences but relates on big ones<sup>150</sup>. To give an example, when comparing the alternative (£250, now) with the alternative (£300, 1 month), the money dimension is the decisive one (given that the difference in time is relatively small in this example). In the context of intergenerational choice people rely on two different dimensions: one is the outcome (e.g. money, number of life saved by a program, and reduction of CO<sub>2</sub> emissions), and the other one is the time horizons considered for the outcome to be realized. In general, if individuals find similarities only in one dimension, their choice would be dependent on the dimension for which there are no similarities. This

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<sup>149</sup> In his paper, Read (2001) performs three different experiments. Results support the hypothesis of sub-additive discounting. However, none of them provide evidence for declining impatience.

<sup>150</sup> Based on this assumption and using some experimental results, Rubenstein (2003) shows that the same arguments used to confute exponential discounting can be applied to reject hyperbolic discounting.

reasoning seems to be consistent with some of the results in support of hyperbolic discounting.

Another critical aspect regards time inconsistency – i.e., the idea that, assuming a chain of reasoning, plans made at one point in time can be contradicted by later behaviour<sup>151</sup>. As suggested by Hepburn (2003) time inconsistency seems to be a matter of concern. The author formally proves that a government that acts naively employing hyperbolic discounting can push renewable resources towards extinction. However, from a social choice perspective many authors argue that the assumption of time consistency is unnatural as time moves on and individuals and governments are legitimated to re-evaluate and revise plans rather than being committed to one policy rule (see for example Henderson and Bateman, 1995, and Heal, 1998). In this vein, Philibert (2006) argues, for example, that behaviour that would be time inconsistent in a deterministic world can be legitimated in an uncertain world.

Groom et al. (2005) analysing the implication of the use of declining discount rates also suggest that this can potentially place more weight on the richer individuals in the future than on the poorer in the present. Finally, some other authors are sceptics about the employment of declining discounting given its causal relationship with procrastination, drug addiction, undersaving, and organizational failure (see Pearce et al., 2003, and Hepburn, 2003). Therefore, governments should be cautious in adopting a schedule of discount rates that justifies these kinds of phenomena (and perhaps collapses in renewable resource stocks).

Despite these criticisms, to date there is no easy resolution to these problems. From a practical point of view, declining discounting and its consequences seem to be no more troubling than other problems – i.e., policy inconsistencies and changes due to external shocks or political shifts (see Groom et al., 2005). As concluded by Pearce et al. (2003, p. 139) “there is – also – a ‘political’ argument in favour of the acceptance of time-varying discount rates: in one swoop they help to resolve the long standing tension between those who believe the distant future matters and those who want to continue discounting the future in the traditional way”. Returning to the

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<sup>151</sup> The identification of this problem is commonly credited to Strotz (1956).

quotation with which this chapter begins, DDR seems to provide a valid compromise into the assignment of responsibility among generations. In this line, Philibert (2006) states that ‘slow effective discounting’ guarantees avoiding the current generation to bear an unlimited responsibility with respect to future generations, as supporters of *strong sustainability* would predict. Although declining discounting relates to the concept of *weak sustainability*<sup>152</sup>, the practice of reducing discounting over time would ensure that damages to the environment would not be negligible even when occurring only in a far distant future. This “makes the weak sustainability paradigm stronger – its exact strength depending on how much the environment assets are valued today” (ibid, p.10). Therefore, since the published paper by Henderson and Bateman (1995), who specifically recommend using hyperbolic discount rates for intergenerational cost-benefit analysis<sup>153</sup>, there has been a large consensus in the literature for the adoption of time-varying discount rates.

The fact that declining discount rates seem to respond both to the requirement of intergenerational equity and efficiency for project’s evaluation can be considered the most convincing aspects leading the UK government to incorporate declining discount rates (varying over time from a maximum of 3.5% over a period of 30 years, to a minimum of 1% for long-term projects over 300 years) into the recent HM Treasury Green Book (2003)<sup>154</sup>.

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<sup>152</sup> Weak sustainability also known in the literature as ‘neoclassical sustainability’ refers to the idea that environmental capital is perfectly substitutable with other types of capital. *Vice versa*, strong sustainability predicts that natural capital should be kept intact given that most of the decisions affecting the environment are irreversible. Weak sustainability has been a key issue for criticisms towards CBA analysis and discounting. As stated by Neumayer (1999), in fact, when considering problems with intergenerational consequences such as the environment, the issue is not discounting, but substitutability. For a detailed discussion on the difference between weak and strong sustainability and its implications for environmental project appraisal, see for example Sáez and Requena (2007).

<sup>153</sup> The authors conclude “For intergenerational cost-benefit analysis we suggest adding hyperbolic discount rate results to the normal framework of a classical exponential discount rate sensitivity analysis, such that...cross-project comparability would not be impaired” (Henderson and Bateman, 1995, p. 420).

<sup>154</sup> The UK government advises using a discount rate of: 3.5% for the first 30 years; 3% from 31 to 75 years; 2.5% from 76 to 125 years; 2% from 126 to 200 years; 1.5% from 201 to 300 years; and 1% over 300 years.

## 5.5 RECENT RESOLUTIONS TO THE DISCOUNTING DILEMMA

### 5.5.1 *The Stern Review and its critics*

Despite decades of debates, at the beginning of the twenty-first century, economists agreed on the adoption of a SRTP (regardless of its declining nature) for intergenerational policy appraisal. However, the recent Stern Review (Stern, 2007), released in late 2006, addressed a new stimulus to this debate. The Stern Review expresses alarm for the impending risks associated to global warming within the next two decades and calls for urgent and vigorous actions by governments. This has generated numerous reactions among practitioners especially because of the policy implications of the report, which strayed so far from the majority of economic analyses that used the same basic data and analytical framework. Criticisms are particularly focused on the fearsome conclusion that failing to invest 1% of GDP per annum to reduce CO<sub>2</sub> emissions (of 30-50 per cent by 2050), might generate a reduction of future global GDP of more than 20% (adjusting also for equity weighting). This result is mainly due to the employment of a very low social discount rate (SDR) used for the evaluation of costs of abatement and prices of greenhouse gases (GHGs).

As in the HM Treasury Green Book (2003), the discount rate in the Stern Review is derived from the Ramsey formula (see equation 5.2 above). The parameters used in the Green Book were: 1.5% for the pure rate of time preference (where 1% is assigned to a catastrophic risk element, and 0.5% represents individuals' preferences over present vs. future consumption); 1% for the elasticity of the marginal utility of consumption (i.e. how much economic growth affects the discount rate); and 2% for the rate of consumption growth. Adding all these terms in equation (5.2) leads to a social discount rate of 3.5%, which is assumed to decline over time towards 1% for long-run projects (i.e. 300 years hence). Stern (2007), accepting the philosophical argument that all generations need to be treated equally, assumes: a pure rate of time preference equal to 0.1% (which is justified by a small probability of catastrophic destruction of humanity and a zero pure rate of time preference); an elasticity of the

marginal utility of consumption being equal to 1%; and a rate of consumption growth set to 1.3%. All these terms lead to a social discount rate of 1.4%.

According to Nordhaus (2007) and Dasgupta (2007), in the Stern Review the estimated costs of failing intervening can considerably be reduced using higher discount rates. The former questions the adoption of a near-zero rate of pure time preference, while the latter suggests the employment of a higher elasticity of marginal utility of consumption. In a brief comment to the Stern Review, Arrow (2007) supports Stern's cost-benefit analysis. However, the author questions the low level of the discount rate. Arrow (*ibid*) argues that even with higher discount rates (commonly favoured by economists) the Stern Review's estimations pass the cost-benefit analysis – i.e., the conclusion that mitigation benefits exceeds their costs still holds with higher discount rates. Weitzman (2007), on the other hand, in line with his previous works (see e.g. Weitzman, 2001), in his critique of the Stern Review advises the adoption of a declining discount rate approaching the Stern level as time goes on.

The Stern Review has also been criticised for the treatment of risk and uncertainty connected to climate change and the evaluation of costs and benefits of climate mitigation. Most of the authors who provided comments on the report suggest Stern's conclusions are inappropriate and express doubts about the validity of its recommendations given that costs of climate mitigation seem to be much smaller than the estimated benefits<sup>155</sup>. Despite the scepticism over the report's implications, many authors supports the Review (see for example Quiggin, 2008), and in his review of criticism to the report, Ackerman (2007, p. 24) states: "The Stern Review is far from being the last word on every aspect of the economics of climate change – but it is much less wrong than the analyses that preceded it. It has decisively laid to rest the notion that standard economic methods somehow counsel timidity in the face of global crisis".

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<sup>155</sup> For a comprehensive review of the Stern Review and its critics, see Ackerman (2007).

### 5.5.2 Dual-rate discounting

While disputes about the implications of the Stern Review continue, a relatively recent strand of literature on the cost-benefit analysis of climate change is focused on dual-rate discounting. In line with the Stern Review, the motivation for dual discounting is to justify an immediate reduction of global emissions. Specifically, the novel approach advises the employment of different discount rates for environmental and consumption goods, with the former rate being lower than that used to discount streams of consumption over time.

Formally, applying dual-rate discounting, equation (5.1) becomes (see Sáez and Requena, 2007):

$$NPV = \sum_{t=0}^T \left( \frac{(B_t - C_t)}{(1+r)^t} \right) + \sum_{t=0}^T \left( \frac{(EB_0 - EC_0)}{(1+er)^t} \right), \quad (5.5)$$

where  $r$  and  $er$  represent respectively the social rate of time preference and the environmental discount rate, while the numerators of the two terms on the right hand side represents respectively the net tangible benefits (i.e. the net shadow price of tangible effects) of consumption streams, and the net intangible benefits (i.e. the net shadow price of intangible effects) of environmental goods<sup>156</sup>.

Yang (2003) first introduces the notion of dual-rate discounting in a utility model where consumption goods and environmental amenities are discounted at different rates<sup>157</sup>. The author provides in this way an alternative justification for the mitigation costs of the Kyoto Protocol, which are generally unaccepted from an economic point of view. The main reason for this reluctance lies on the idea that costs of emission

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<sup>156</sup> Note that this is what distinguishes the dual-rate discounting approach from the K-F approach (see Krutilla and Fisher, 1975). In the latter, in fact, the rate of discounting is equal to the SRTP either for discounting streams of consumption or for environmental assets, and what changes is the value of environmental goods that are supposed to increase over time. In the former, the value of environmental goods stays the same over time, and what changes is the level of discount rate that is assumed to be lower than that used for discounting consumption streams.

<sup>157</sup> Yang (2003) proposes a similar approach to that shown in equation (5.5). However, rather than evaluating environmental goods or costs in current cash terms, the model considers an increasing value of the annual environmental costs and benefits. As suggested by Sáez and Requena (2007, p. 718), this not only would be difficult to implement, but also it results in double accounting “since the rationale for a lower environmental discount rate already includes the hypothesis of a declining consumption of marginal utility for environmental goods”.

reductions are to be paid immediately and mitigation damages only occurs in the far-distant future. That is to say, discounting represents the problem. Using a RICE (multi-region dynamic general equilibrium model of economic growth and climate change) model à la Nordhaus and Yang (1996) and Nordhaus and Boyer (2000), Yang (2003) proves that dual discount rates can justify the Kyoto commitments<sup>158</sup>.

Later works in this area have critically analyzed the validity of dual-rate discounting. Tol (2004) questions the Yang-approach on the grounds that dual discount rates are not derived endogenously in the model and provides an alternative approach. In his model, the difference between the rates of discounting is determined endogenously by the marginal willingness to pay for environmental quality (which increases with income). Tol (ibid) recommends the use of this approach when the marginal willingness to pay is known, and suggests the adoption of the Yang (2003) model when this information is not available. In a recent contribution, Weikard and Zhu (2005) suggest dual-rate discounting can only be justified when future prices of environmental goods are not available, or when consumption goods and environmental goods are not substitutable. The authors show that in the first case dual-rate discounting is equivalent to the case of uniform discounting when accounting for correct prices, while in the second scenario their conclusions hold only if the relative prices of the two goods are not defined. In the same line, Kögel (2009) formally proves that substitutability and discounting are two issues closely related to each other. The author concludes that the difference between environmental and consumption goods discount rates is larger, the lower the intratemporal rate of substitutability between environment and consumption goods within a period.

Dual-rate discounting seems to reconcile efficiency and sustainability issues into what is generally known as the Extended or Environmental Cost-Benefit Analysis (ECBA)<sup>159</sup>. Analyzing the effects of dual discounting for different afforestation schemes in the UK, Kula and Evans (2011) conclude, for example, that dual-rate

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<sup>158</sup> The Stern Review certainly represents another attempt to provide a solution to this dilemma. However, as discussed above, the adoption of a very low discount rate based on ethical considerations has been disproved on several grounds.

<sup>159</sup> This term is commonly associated in the literature with that part of cost-benefit analysis that tries to adapt the analytical framework to the demand for sustainability.

discounting provides more information about environmental impacts of different projects, thus helping policy makers to select more efficient and sustainable investments.

However, what value should the environmental discount rate take on? Published works in this area of research usually suggest an environmental discount rate (also called ‘ecological discount rate’) on average 2% lower than that used for financial evaluation.<sup>160</sup> Although there is not a unique answer to this question, and probably – as suggested by Almansa and Martínez-Paz (2011) – it will never be possible to find one, economists recognize the importance of dual discounting and express enthusiasm over the novel approach especially for intergenerational problems. Nevertheless, further research is needed to strength these conclusions and to understand which are the most suitable areas of application of differential discounting.

Table 5.1 summarizes selected alternative approaches (and their relative criticisms) to the choice of the social discount rate for long-run projects’ evaluation in environmental contexts.

## **5.6 MODELLING INTERTEMPORAL PROBLEMS: ILA *VERSUS* OLG MODELS**

As with the choice of the functional form and the value of the discount rate, problems arise also over the choice of models that deal with intergenerational problems. In general, the literature is divided between two different schools of thought. The first one supports models related to the Ramsey formula and assumes an infinite-lived agent (ILA models) acting through his/her saving/investment decisions as a trustee on behalf of both the current and future generations. The second one proposes an approach with finite-lived agents who maximize their own utility simultaneously in different segments of their life cycle, i.e. overlapping generations (OLG) models.

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<sup>160</sup> See Almansa and Martínez-Paz (2011) for a review of specific environmental discount rate values proposed in the literature.



**Table 5.1**

Alternative approaches to the choice of SDR (selected studies) in environmental contexts

Proposed resolution	Author/s	Major Criticisms
Early resolutions		
Constant reduced discount rate (i.e. SRTP) for long-run projects	Nordhaus (1999) Cline (1999)	<p>A lower discount rate for long-run projects:</p> <ul style="list-style-type: none"> <li>- asks for more sacrifices to current generations</li> <li>- might generate an increase on global investments, thus reducing natural resources and increasing environmental degradation</li> <li>- does not necessarily guarantee equity among generations given that future generations have neither political power nor representatives</li> </ul> <p>Determining the value attached to the SRTP could be difficult and might result in arbitrary choices</p>
Intergenerational CBA (i.e. intergenerational distributional weights in CBA + constant SRTP to compute the NPV)	Kula (1988) Padilla (2001) Padilla and Pascual (2002)	Practical problems arise from the calculation of weights to be assigned to different generations
K-F approach (i.e. increasing value of environmental assets + constant SRTP to compute the NPV)	Krutilla and Fisher (1975) Fisher and Kreutilla (1985) Hasselman (1999)	The assumption of an increasing willingness to pay (WTP) for environmental goods over time pose a practical problem of determining the WTP for future environmental assets
Declining Discount Rate (DDR)	Weitzman (1994, 1998, 1999, 2001, 2007) Gollier (2002a, 2002b, 2004, 2009a, 2009b) Gollier and Weitzman (2010) Chichilinsky (1996, 1997, 2009) Li and Löfgren (2000)	<p>The assumption of a chain of reasoning behind declining discount rates might generate problems of <i>time inconsistency</i> – i.e. plans made at one point in time can be contradicted by future behaviour</p> <p>DDRs explain problems such as procrastination, undersaving, and drug addiction, thus government should be cautious in adopting this schedule of discounting</p>

**Table 5.1 Continued**

Proposed resolution	Author/s	Major Criticisms
<b>Recent resolutions</b>		
Very low SRTP (= 1.4%) for climate change policy appraisal	Stern (2007)	The low rate of discount generates high estimated costs of failing intervening to immediately reduce GHGs emissions. However, these costs could be lower by using higher ‘feasible’ discount rates.
Dual-Rate Discounting (i.e. for NPV’s calculation this approach assumes a SRTP for consumption goods and an Environmental Discount Rate –EDR – for environmental goods that are evaluated at current time)	Yang (2003) Tol (2004) Weikard and Zhu (2005) Kögel (2009) Kula and Evans (2011) Almansa and Martínez-Paz (2011)	Determining the value attached to the SRTP could be difficult and might result in arbitrary choices

These models have two different views on intergenerational equity. In ILA models there is a representative ‘immortal’ agent that optimizes the sum of discounted utilities of present and future generations and intergenerational equity is guaranteed by his/her altruistic preferences towards descendants – i.e., the so called ‘bequest motive’. By contrast, in OLG models altruistic considerations are generally absent. The literature has mainly used the ILA approach for evaluating climate change policies that aim at reducing CO<sub>2</sub> emissions (see for example, Peck and Teisberg, 1992, Nordhaus, 1994, Manne et al., 1995, Nordhaus and Yang, 1996, and Manne, 1999). Is this because ILA models provide more pleasing results than OLG models? Not surprisingly, also in this case opinions differ widely.

In many respect, the ILA approach seems to be adequate to analyse the allocation of assets and resources across generations. Equity between generations is achieved by adding up each generation’s utility level, where utilities depend only on consumption and they are properly discounted providing a measure of social performance (see Solow, 1986). However, there are also good reasons to consider the adoption of OLG models instead.

On the one hand, in OLG models altruism and ethical considerations are not a matter of concern<sup>161</sup> as agents save during their working time and spend all their savings when they retire. This framework according to many authors (see e.g. Marini and Scaramozzino, 1995, Schelling, 1995, and Azar and Sterner, 1996) seems to be more realistic since it assumes a finite time span of human's life and provides a closer representation of the demographic structure of societies especially in times with demographic shocks such as the 21<sup>st</sup> century. On the other hand, some authors point out that the ILA approach is unrealistic because it considers an exogenous discount rate, while a 'correct' weight of future generations well-being would call for an endogenous rate of discounting depending on several variables and phenomena (see e.g. Howarth and Norgaard, 1992, and Gerlagh and van der Zwaan, 1999) – i.e., demographic composition and distribution of resources and assets across generations. These aspects seem to play a major role when considering intergenerational problems such as climate change and protection of global environment (see e.g. Gerlagh and van der Zwaan, 2000).

Given that the importance of altruism on intergenerational environmental issues has been suggested by many authors (see for example Löfgren, 1991; and Hultkrantz, 1992), there have been some attempts in the literature to construct OLG models where saving decisions are driven by individuals' altruistic preferences (as in Barro, 1974, and Weil, 1987), rather than concerns for their own retirement. The rationale behind this framework is to overcome the criticism that in OLG models savings decisions disregards future generations' well-being. Jouvét et al. (2000), for example, analyse an OLG model of pollution where individuals are altruistically related to their offspring<sup>162</sup>. The authors show that the trade-off between intergenerational altruism and consumption of private goods drives preferences towards a cleaner environment. The more a society cares about their offspring's welfare, the less it consumes and pollutes. However, from a social optimum perspective, despite altruistic preferences, the model suggests public interventions as social optimum differs from its private value. This is mainly due to two externalities prevailing in the

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<sup>161</sup> Rather than relying on altruistic preferences, Howarth and Norgaard (1995) e.g. advice using public interventions. This is because individuals do not internalize all externalities, thus leading to suboptimal outcomes.

<sup>162</sup> Other studies using this framework for natural resources are those provided by e.g. John et al. (1995) and Marini and Scaramozzino (1995).

model: one, which is well known in public economics, derives from the fact that individuals under-contribute to pollution abatement; the other one regards the overaccumulation of pollution capital as private individuals do not take into account the effect of production on pollution. Jouvet et al. (ibid) show that the social optimum can be decentralized by means of a subsidy on voluntary contribution to pollution abatements (to avoid free riding), and by using a tax on capital accumulation so that the economy accumulates the optimal capital stock (to achieve the so called modified golden rule).

Although these models seem to be attractive from a theoretical point of view, some authors (see e.g. Gerlagh and van der Zwaan, 2000) point out that they are similar to an ILA approach in its treatment of discounting as the social discount rate is commonly set equal to the private degree of intergenerational altruism, which is exogenously determined in the models. In addition, recent empirical evidence suggests that the altruistic bequest motive is rather weak (see e.g. Kopczuk and Lupton, 2007).

Comparing ILA and OLG models many authors conclude that the two approaches do not significantly differ in terms of policy implications for climate change and greenhouse gas abatement (see for example Stephan et al., 1997; and Manne, 1999). Therefore, they recommend them as complementary models to the economic analysis of climate change. However, others (see for example Howarth, 1996, 1998) find substantial differences between results obtained with OLG and ILA models. Following the assumptions in Nordhaus's (1994) Dynamic Integrated Model of Climate and the Economy (DICE)<sup>163</sup>, Howarth (1998), for example, analyses a two-period OLG model of climate change and finds that in contrast to models based on transfers of wealth from present to future generations, a utilitarian OLG framework suggests quite aggressive greenhouse gas emissions abatement justified in terms of economic efficiency. Furthermore, Howard (ibid) explicitly proves that ILA models can be considered as a reduced form of OLG models where important features of the demographic distribution are qualitatively omitted. Later, Gerlagh and van der Zwaan (2000) reach even stronger conclusions and question the adoption of ILA

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<sup>163</sup> In his model, Nordhaus (1994) adopts a utility function that is logarithmic in consumption and discounts future welfare at a constant 3% discount rate.

models for climate change policy measures. They attribute the differences between their results and those obtained by Stephan et al. (1997) and Manne (1999) explicitly to a predicted longer life expectancy and to a more realistic adoption of a three-time period OLG model.

The debate between proponents of the two approaches continues. In a very recent contribution, Schneider et al. (2012), for example, showing to what extent ILA models can be compared to OLG approaches, point out further shortcomings of using ILA models, that is:

- ILA models implicitly assume that social planners adopt a higher rate of pure time preference than that used in an equivalent OLG model;
- ILA models do not capture intragenerational problems. This is because using an utilitarian OLG model the authors find out that an equal treatment of present and future generations is reached at the expense of an equivalent unequal treatment of generations alive at a given point in time;
- Finally, in contrast with ILA models, a utilitarian OLG economy can deal with problems occurring if the intergenerational social discount rate does not coincide with that of individual households, which would suggest implementing different age-discriminating tax schemes to guarantee redistribution among generations at each point in time.

Therefore, although for many years infinitely-lived agent models offered a very convenient framework for long-term analysis, in contrast with Tóth's (2000) conclusions<sup>164</sup> and according with recent contributions to the literature, results from the two approaches might be significantly different from each other when they come to environmental problems occurring decades ahead from now. However, at this point, it seems that an overall assessment of which model fits better to the problems of climate change and its consequences across generations cannot be made.

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<sup>164</sup> Describing models for intergenerational problems, Tóth (2000, p. 132) argues "At this point, it seems that ILA as an abstraction offers a very convenient framework for long-term analysis without significantly distorting the policy insights".

## 5.7 SHOULD WE DISCOUNT ALL GOODS THE SAME?

### 5.7.1 *Tradable versus non-tradable goods*

While there are still many difficult questions to be resolved in choosing the rate of discounting, its functional form and related models to deal with long-term project evaluation, there is a strand of literature that questions the practice of discounting in the public sector and, when admitting there exists some justifications for time-discounting, questions the idea of discounting all goods at the same rate.

Henderson and Bateman (1995, p. 414) describing the SRTP-SOC dilemma argues: “Even when one has chosen either the opportunity cost of capital or the consumption rate of interest (or, in more sophisticated models, some combination of the two...) as the appropriate reference point from which to derive a discounting numeraire, the calculation of a single ‘correct’ discount rate for all possible projects is not uniquely possible. This is not a recent conclusion...but one that has become increasingly accepted”. In particular, according to Schimd (1989) and Luckert and Adamowicz (1993), Henderson and Bateman (1995, p. 414) conclude that “society may reasonably be expected to have different discounting preferences for differing commodities”.

It is common practice in economics to convert all goods to common monetary equivalents. The rationale behind this conventional practice lies on the assumption that all goods and services are potentially tradable with money. However, according to Goodin (1982) there are particular types of commodities that fall into the category of ‘non-tradable’ goods (such as the environment and heath) for which the above considerations might no longer hold. Specifically, non-tradable goods do not admit *ex ante* monetary compensations unless non-tradables can be sacrificed with equivalent goods – i.e., a tree life for tree lives – according to the *restricted* opportunity cost argument. However, there are some limitations to this approach (see Goodin, *ibid*). First, when the stock of non-tradables is deteriorating over time (rather than increasing), the opportunity cost argument can lead to negative discount rates

accounting for higher weights to future enjoyment of the goods. Secondly, the opportunity cost argument cannot tell us if consumption of non-tradables is preferred now rather than later. Finally, the most interesting aspect behind the restricted opportunity cost discounting is that it gives rise to the question of whether decision makers should treat all goods similarly or should instead use different discount rates and functional forms for different commodities.

On these grounds, during the last decade laboratory experiments have examined temporal discounting for outcomes other than monetary-related ones (e.g., monetary *versus* health/environmental domains). Before proceeding with the description of some empirical evidence in this area of research, the next section provides a brief overview of available methods to measure discount rates.

### ***5.7.2 Modelling the discount rate***

The literature offers a wide variety of procedures to estimate individuals' time preference. Broadly, these methods can be divided into the following categories: field studies, where discount rates are inferred from actual behaviour of individuals' daily life; and experimental studies, where individuals take part of surveys in which they face real or hypothetical intertemporal trade-offs (see Frederick et al., 2002). In this chapter and for the purpose of this analysis only experimental studies will be analysed.

The most commonly used elicitation procedures are *choice tasks* and *matching tasks*. In the first approach, respondents typically face the choice of getting (or losing) a particular outcome immediately or later in the future. Rather than using a single choice scenario, however, individuals are presented with a series of alternatives (e.g. *titration* procedure). This helps to provide a more accurate estimation of the discount rate and avoid restricting respondents' choice to a lower or upper bound of discounting rates. In *matching tasks* respondents 'fill in the blank' to compare intertemporal alternatives – i.e. £100 now equals \_\_\_\_ 100 years from now. Some other studies, although a minority, use a *rating task* approach (where respondents evaluate the attractiveness or averseness of outcomes occurring at

different times), or *pricing tasks* (where individuals express their willingness to pay to obtain – or avoid – specific outcomes over time). Alternatively, relative recent experimental methods are: *sequence tasks*, where respondents are asked to state their preferences over programs with ‘sequence’ of outcomes occurring over time; and *equity tasks*, where people choose between receiving (losing) an outcome evenly distributed over a certain period of time, and receiving the same outcome only in one period.

From all these methods an implicit discount rate is derived using the NPV calculation. To give an example, in *choice tasks* for monetary domains, if a person shows indifference between receiving £100 now or £150 1 year from now, the resulting discount rate would be 50%, because this value satisfies the equation  $100 = (1/(1+r)) * 150$ .

Like all elicitation procedures it is quite difficult to assess which method is preferable to the others, given that all of them show possible drawbacks. According to Frederick et al. (2002), e.g. *choice tasks* can be linked to anchoring effects<sup>165</sup>, while elicitation methods based on *matching tasks* may not reveal true time preferences, but could be based instead on other simple reasoning processes.

In general, evidence obtained from experimental analyses shows that individuals tend to value more (i.e. discount more) immediate gains (both in terms of life and monetary gains), than that occurring in the distant future. However, the short time range (i.e. few years or even months) applied in these studies might bias results, which generally offer very high discount rates<sup>166</sup>. Furthermore, results differ among the various procedures adopted in the experiments, which prevents us to make general conclusions about individuals’ time preference especially for long-run project evaluation. In this vein, Frederick (2003), for example, using a large variety of the above-described elicitation procedures cast doubt on previous claims that the

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<sup>165</sup> Anchoring effects rely on the idea that individuals might be influenced too heavily by the first piece of information (i.e., the anchor) offered in the *choice task*.

<sup>166</sup> In Frederick et al.’s (2002) review of 34 studies attempting to infer empirically discount rate values, only the study provided by Johannesson and Johannesson (1997) encompass an intergenerational timeframe extending their analysis from 6 years to 57 years with a resulting discount rate ranging from 0% to 3%.



public values future lives much less than present lives (as suggested e.g. by Cropper et al. 1994, and Johannesson and Johannsson, 1997, among others).

### ***5.7.3 Experimental evidence for different discount rates***

Irrespective of these considerations, the most widely cited studies among those who analyse differences in discounting across domains are those provided by Chapman and Elstein (1995), and Chapman (1996a, 1996b), where financial vs. health scenarios are compared. Using different elicitation methods (i.e. matching and choice tasks), these studies show a very low correlation in discount rates between domains and, by contrast, higher correlation within domains. It turns out that policy makers should use different discount rate for different domains.

Recent theoretical research (e.g. dual-rate discounting) is also suggesting adopting different discount rates in different contexts – i.e., financial vs. social vs. environmental scenarios (see also Krantz and Kunreuther, 2007). However, only a few studies examine and compare discounting between environmental outcomes and financial and/or health goods. Discounting seems also to be generally less pronounced for environmental scenarios. In their literature review about environmental risk perception, Gattig and Hendrickx (2007) for example state that almost 30-50 per cent of respondents do not discount environmental outcomes. However, the studies they consider do not compare different scenarios and domains.

To the best knowledge of the author there are only three studies that analyse the differences between environmental and other domains. Guyse et al. (2002) compare environmental outcomes (i.e. water and air quality) with preferences for *sequences* of health and monetary outcomes in short (5-years) and long (50 years) time horizons. They found that participants prefer constant or increasing sequences for water and air quality improvement (as well as health outcomes), and decreasing sequences for monetary gains, suggesting higher discounting for monetary payoffs. However, likewise Böhm and Pfister's research (2005), Guyse et al. (2002) do not control for other confounding factors, such as the valence of the outcomes that can generate possible gain/loss asymmetries observed in the monetary domain. In addition Bhom

and Pfister's study presents scenarios referred to losses imposed to others, which may bias respondents' perception of tasks and therefore their conclusions.

These problems have recently been overcome by Hardisty and Weber (2009) who investigate possible domain differences in time preferences using different gain/loss scenarios for environmental, health and monetary domains. In three different studies, the authors compare individuals' choices between hypothetical financial, environmental and health gains and losses, occurring immediately or with a delay of 10 years. In contrast with previous research on discount rates in monetary and nonmonetary domains (e.g. health) (see for example Chapman, 2003), the authors conclude that there is no significant difference between discount rates in different domains. In addition, correlation within valence (across domain) seems to be stronger than that within domain (across valence). Thus, discount rates are more contexts related than domain dependent, i.e. in order to predict how much someone discounts health gains it is more useful to know how much they discount monetary and environmental gains than knowing how much they discount health losses. It turns out that, discount rates assessed in laboratory for one domain can be also applicable to other contexts. This is an unexpected result, which however represents good news for researchers and politicians who generally attempt to set a unique official discount rate for judging long-term projects and investments (see Hardisty and Weber, 2009).

However, although these studies represent a first step towards a possible explanation for discount rates differences (if any) in environmental domains, none of them directly control for attitudes to risk. In particular there may be a difference in sensitiveness to risk in different domains (e.g., a person may be more risk averse in a health context than a money one). According to Loewenstein et al. (2001) in fact people are driven by two different mechanisms when judging risk situations: one is a cognitive evaluation mechanism (i.e., 'consequentialist'), where individuals base their decisions according to rational severity and likelihood of outcomes; the other one is an emotional evaluation mechanism where subjects are driven by (negative) emotions such as fear, anxiety and worry<sup>167</sup>. Thus, individuals' risk judgements,

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<sup>167</sup> A similar approach is provided also by Slovic et al. (2004, 2007).

risky decisions and behaviours might be influenced by emotion-based reactions in situations where affective responses to risk are more prominent.

A further distinction is provided by Böhm and Pfister (2000, 2005), who separate the nature of emotions generated by consequentialist and ethical concerns. The former evaluations (i.e., loss-related concerns) comprise the seriousness and probability of potential consequences caused by possible losses. The latter (i.e. ethical concerns) regards the causal attribution of the risk (e.g. natural or human agents) and becomes stronger when actions or events violate ethical principles or norms. Thus, loss-related concerns generate feelings of fear and sadness, whilst ethical concerns give rise to feelings of anger or guilt. Böhm and Pfister (2005) highlight that consequence-based emotions lead individuals to prevent, avoid, and alleviate consequences. By contrast, ethical emotions generate feelings of punishment and retaliation. Therefore, it is more likely that temporal discounting occurs when risk is influenced by consequence-based emotions. On the other hand, where ethical considerations (such as social justice, equitableness of outcomes, and responsibilities towards future generations) prevail, temporal discounting is less pronounced, because time does not affect individuals' morality.

## **5.8 CONCLUSIONS**

This chapter critically evaluates the relevance of discounting for intergenerational problems such as climate change and environmental protection. From the discussion outlined above, it is evident that the choice of the discount rate plays a crucial role for *ex ante/ex post* project evaluation. The literature has provided a myriad of methods and arguments to support/discredit possible candidates as social discount rates in CBA. The difference among various approaches depends mainly on different views on: whether or not public investments affect private ones (i.e. SOC vs. SRTP), whether or not intergenerational equity considerations are taken into account (which predicts the adoption of e.g. a lower rate of discounting for long-run projects or discounting in the form of a hyperbolic function), and whether or not different goods should be evaluated in different manners (i.e. dual-rate discounting approach). Other methods suggest abandoning discounting or employing a 'modified CBA' to take

into account intertemporal distributional problems (i.e. Intergenerational CBA or K-F approach).

The choice of the social discount rate seems also to play a role for modelling intertemporal problems. The current debate over the adoption of ILA *versus* OLG models for ‘correct’ estimates of emission abatement costs and benefits, in fact, poses additional emphasis to the problem – i.e. with the former strengthening the employment of an exogenous discount rate, while the latter suggesting a more ‘correct’ endogenous rate of discounting. Recent contributions to the literature underline the weaknesses of the two approaches and provide evidence for significantly different policy implications.

In line with recent theoretical models, behavioural economics also seems to suggest that individuals’ time preferences for intertemporal problems change according to the nature of the goods. However, although these results are well established in the health/monetary experimental literature, the scarce contributions analysing the differences among monetary, and/or health/environmental domains provide controversial evidence. This may be due to deficiencies in taking into account the different factors that affect discounting preferences for different commodities, thus raising the following questions: how do people form beliefs over environmental outcomes? And how are these beliefs influenced by ethical considerations (i.e., intergenerational equity concerns and environmental morale)? To date these remain unexplored questions in the literature. Understanding *actual* individuals’ perceptions of intertemporal choices in light of their ethical attitudes might be of fundamental importance for policy implications and more importantly for sustainable development and welfare considerations. On the one hand, ethical concerns playing a role would suggest governmental interventions to sensitize individuals towards more eco-conscious behaviours. On the other hand, results might provide further evidence for dual-rate discounting in environmental contexts. These issues are addressed and discussed in the next chapter.

## Chapter 6

# ENVIRONMENTAL MORALE, DISCOUNTING AND INTERGENERATIONAL PREFERENCES

### 6.1 INTRODUCTION

The survey outlined in the previous chapter suggests that understanding the factors that affect discounting is of crucial importance in determining decisions involving trade-offs between outcomes in this generation and in future generations. The behavioural literature has been mainly focused on which discount rate and functional form should be used for discounting. There are few contributions attempting to analyse *actual* individuals' perception of intertemporal choices among different domains, and the available studies provide controversial results. As discussed in the previous chapter, in fact, some analyses support the adoption of different discount rates for different commodities (see e.g. Böhm and Pfister, 2005, and Gattig and Hendrickx, 2007) – i.e., discounting is domain specific. Alternatively, some others suggest to use a single discount rate for all goods (see e.g. Hardisty and Weber, 2009) as differences are context (or valence) and not domain dependent.

However, despite the emphasis ethical considerations have received in the theoretical literature of discounting, none of these studies directly analyses the impact of environmental morale on environmental time preferences. The present analysis seeks therefore to further explore whether temporal discounting is valence and/or domain specific and to assess whether environmental morale influences differences in discount rates and intergenerational preferences. A survey investigation was employed to analyse these particular issues.

The chapter is organized as follows. The next section describes the rationale and aims of the survey analysis. It is followed by a detailed description of the questionnaire in section 6.3. Section 6.4 reports the results obtained by exploring the relationship between environmental morale and discounting, whereas a brief description of the results derived analysing the linkage between environmental

morale and intergenerational preferences is presented in section 6.5. Section 6.6 provides concluding remarks.

## 6.2 RATIONALE AND AIMS OF THE STUDY

In general, regardless of valence, similar goods should be discounted the same<sup>168</sup>. However, an increasing number of studies in the literature (see e.g. Thaler, 1981, Loewenstein, 1987, and Hardisty and Weber, 2009) find discounting to differ among gains and losses. This leads to one of the major anomalies in intertemporal preferences – i.e., the gain-loss asymmetry (or sign effect), whereby losses are generally discounted at a lower rate than gains. Along the same lines, when domain matters (see e.g. Goodin, 1982), significant differences should be found in the way people discount e.g. monetary, environmental and health outcomes. Given that these arguments are not mutually excludible, in the current study the first hypothesis to be tested is:

*Hypothesis 1:* Discounting is valence and/or domain dependent.

As stated in previous chapters, the psychological literature suggests that environmentally-friendly behaviours are driven by environmental morale as the intrinsic motivation to contribute to a better environment. However, to the best of the author's knowledge, there are no empirical analyses in the literature that attempt to explain the connection between high/low environmental morale and discounting environmental outcomes. More specifically, holding environmental morale constant (i.e., high vs. low), do people exhibit different time preferences towards the environment? Does environmental morale affect discounting? This leads to the following hypotheses to be tested:

*Hypothesis 2:* Individual time preferences over the environment differ with different levels of environmental morale.

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<sup>168</sup> Put in another way, the amount of money an individual is willing to accept to delay an undesirable outcome should be equivalent to that he/she would pay to postpone an undesirable outcome of the same nature.

Hypothesis 3: Environmental morale (i.e., ethical considerations) influences differences in discount rates.

However, what determines the extent to which environmental morale might influence discounting? According to the literature, there are two different neural systems that influence the way people form expectations on future outcomes (see Loewenstein and O’Donoghue, 2007): a *deliberative system* that assesses options in a cognitive fashion (e.g. based on an evaluation of likely consequences), and an *affective (or emotional) system* that influences behaviour through emotional states (e.g. hunger, anger, and fear). The former, cares about both the short and long-term payoffs. The latter is driven mostly by short-term payoffs. How can environmental morale interact with these systems? Figure 6.1 provides a schematic representation of possible predictions<sup>169</sup>. As shown in Figure 6.1, environmental morale can influence individuals’ responsiveness to environmental stimuli in two different ways.

First, in line with Frederick (2003), ethical considerations can activate the deliberative system *via* e.g. social justice and responsibility ascriptions towards future generations, which will induce people with high environmental morale to discount environmental costs and benefits at a lower rate (if any) relative to people with low environmental morale. In this case, discounting is not normatively justified and environmental outcomes should receive equal weight regardless of their occurrence and valence. Alternatively, it might be argued that environmentally-friendly individuals might exhibit negative discount rates (i.e., they can inflate future benefits and costs), meaning that they will prefer to experience gains later than now, and losses now rather than later. The deliberative system assumes therefore a far-sighted perspective.

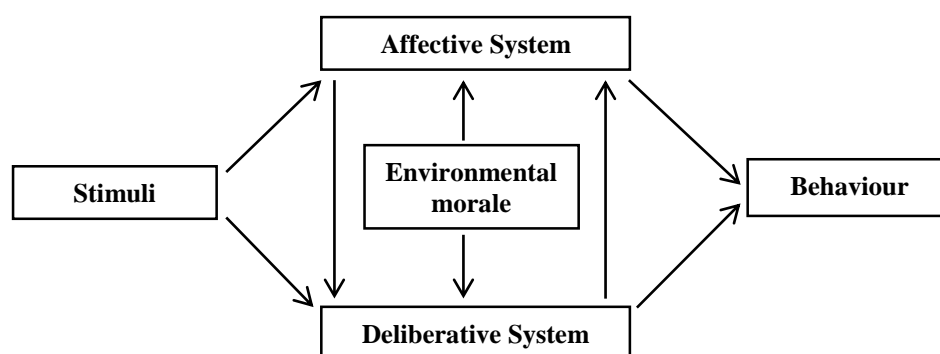
Secondly, ethical considerations can exacerbate the desire and/or visceral enjoyment of having a better environment, which ultimately translates into affect-

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<sup>169</sup> The model is adapted from Loewenstein and O’Donoghue (2007) who provide a formal representation of a dual-system preference model by describing its implications for intertemporal choices. This model is also referred in the literature as the delta-beta preference model (see e.g. Hardisty and Weber, 2009, and Tsukayama and Duckworth, 2010).

based preferences for immediate outcomes (i.e., present bias or impatience)<sup>170</sup>, or in Loewenstein's and O' Donoghue (2007, p. 1) words "the heat of the moment". It turns out that the affective system can lead to more myopic behaviours. According to previous analyses (see e.g. Tsukayama and Duckworth, 2010), therefore it might be expected that, when facing decisions involving immediate *versus* future payoffs, compared to those with low environmental morale, individuals with high environmental morale will have steeper discount rates for environmental gains (i.e., they will be impatient). In the same fashion, rather than showing equal discount rates for gains and losses; they will discount gains more than losses.

**Figure 6.1:** Environmental morale and dual-process preference model



The considerations above lead to the conclusion that human's behaviour is determined by the interplay<sup>171</sup> of these conflicting responses to a situation. Given the lack of empirical analysis in this area of research, it is difficult to make predictions about which of the two systems will dominate. In general, it might be expected that, if ethical concerns matter, those with high environmental morale will exhibit a lower discount rate compared to those with low environmental morale. As suggested by Hendrickx and Nicolaij (2004) who analyse the reasons for discounting, or not,

<sup>170</sup> Present bias or impatience is referred in the literature as an 'irrational' disutility of waiting. For gains this translates into the desire of enjoying them immediately (i.e., higher discount rate), whereas for losses this translates into the desire of getting them out of the way immediately (i.e., lower discount rate). According to the Loewenstein's (1987) model of *savouring* and *dread*, people obtain, in fact, a positive utility from anticipating gains and a negative utility from anticipating losses and for this reason they tend to postpone them.

<sup>171</sup> Emotional inputs can help the deliberative system to assess the value of future consequences. In the same vein, the deliberative system can mitigate emotional inputs. For a discussion see Loewenstein et al. (2001), and Loewenstein and O'Donoghue (2007).



environmental outcomes, ethical considerations, in fact, seem to play a major role when comparing environmental risks to other (more personal) types of risks. Therefore, it can be expected that environmentally-friendly people will be more concerned about responsibility ascriptions towards future generations, especially when the consequences of the event can be attributed to anthropogenic rather than natural causation (see Böhm and Pfister, 2005). However, according to previous studies in different areas of research (Tsukayama and Duckworth, 2010), it might also be the case that environmentally-friendly people will be more impatient for (or tempted by)<sup>172</sup> environmental outcomes compared to e.g. monetary and health outcomes.

The present study differs from those of Hardisty and Weber (2009) and Böhm and Pfister (2005) since the former do not control for ethical considerations and the latter manipulate time perspective in a between-subjects design, so that it is not possible to infer any conclusion about individuals' discount rates. Furthermore, this analysis accounts for differences in discounting when considering different generations, an issue that has been neglected in this area of research.

## **6.3 DESCRIPTION OF THE SURVEY**

### ***6.3.1 Procedure***

In order to investigate possible differences in time preferences in different domains, the present study compares discounting for hypothetical monetary gains and losses with discounting of hypothetical environmental and health gains and losses. The empirical analysis is based on data from a survey investigation conducted in Bath (United Kingdom) which was carried out in November – December 2012. Respondents were chosen among the student population. The questionnaires were collected from first, second, and third year Economics lectures in the University of

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<sup>172</sup> Tsukayama and Duckworth (2010, p. 72) define temptation as “the visceral attraction to and enjoyment of a reward, regardless of the associated harm”.

Bath<sup>173</sup>. As with the survey described in chapter 3, before proceeding with the collection of the questionnaires, two pilot analyses<sup>174</sup> were carried out. After introducing the necessary changes a final version of the questionnaire was built according to respondents' suggestions and field-experts' opinions. The survey was administered by the author according to the following procedure. After a brief introduction to the study, participants received a printed version of the questionnaire. The following preamble was read out:

‘The purpose of this questionnaire is to gather information on individuals’ time preferences. The questionnaire is divided into three different sections. In ‘SECTION 1’ and ‘SECTION 2’ you are requested to answer questions about hypothetical scenarios regarding time preferences in different contexts. In ‘SECTION 3’ you are asked to provide general information about yourself and to state your opinion on particular issues.

In the questionnaire you will find questions with the following format:

*For each pair of values, please select the answer that best reflects your personal preferences.*

A.	<input type="checkbox"/>	50 apples	or	<input type="checkbox"/>	45 apples
B.	<input type="checkbox"/>	50 apples	or	<input type="checkbox"/>	50 apples
C.	<input type="checkbox"/>	50 apples	or	<input type="checkbox"/>	55 apples
D.	<input type="checkbox"/>	50 apples	or	<input type="checkbox"/>	60 apples
E.	<input type="checkbox"/>	50 apples	or	<input type="checkbox"/>	65 apples
F.	<input type="checkbox"/>	50 apples	or	<input type="checkbox"/>	70 apples

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<sup>173</sup> Note that, likewise the survey described and analysed in chapters 3 and 4, also in this case not all the students taking the Economics lectures were enrolled in the Economics degree programme (e.g., for first year students roughly two-thirds were formally registered in the Economics Department at the University of Bath). However, in line with Cipriani et al. (2009) the objective here is to investigate whether behaviour is consistent with the hypothesis that different levels of indoctrination into economics may have an impact on discounting. These issues will be further discussed below.

<sup>174</sup> The first pilot analysis involved a sample of 46 respondents interviewed among the student/adult population of the University of Bath. The second one included approximately 20 students recruited among the student population of the University of Bath.

For these questions you are supposed to tick only ONE box for each pair of values, i.e.,:

A.	<input checked="" type="checkbox"/>	50 apples	Or	<input type="checkbox"/>	45 apples
B.	<input checked="" type="checkbox"/>	50 apples	Or	<input type="checkbox"/>	50 apples
C.	<input type="checkbox"/>	50 apples	Or	<input checked="" type="checkbox"/>	55 apples
D.	<input type="checkbox"/>	50 apples	Or	<input checked="" type="checkbox"/>	60 apples
E.	<input type="checkbox"/>	50 apples	or	<input checked="" type="checkbox"/>	65 apples
F.	<input type="checkbox"/>	50 apples	or	<input checked="" type="checkbox"/>	70 apples

To answer all the other questions, please tick ONE of the boxes next to the answer(s); or, when appropriate, write your answer in the space provided.

I would be very grateful for your contribution to this study. All responses will remain anonymous. Thank you for your help.’

Participants were then asked to complete the questionnaire on their own and without consulting their colleagues. The time taken to hand out the questionnaires; to complete and collect them again was approximately 20 minutes. In all, 450 questionnaires were collected. Data from 8 participants were excluded. Among them, 3 did not complete the study, 2 switched to the titration items back and forth more than once, and following the Hardisty-Weber response criteria, the other three questionnaires were dropped if respondents preferred more losses or fewer gains – i.e., preferring £10000 immediately to £18000 ten years from now yet also finding it equally attractive to receive £15000 ten years from now to £10000 immediately. The sample was 39% female and 61% male. About 60% of respondents were first year economic students, 18% were second year students and the remaining 22% were third year students.

### ***6.3.2 Description of the questionnaire***

For comparisons with previous analyses, ‘SECTION 1’ of the questionnaire was inspired by a recent paper of Hardisty and Weber (2009) who carried out a survey investigation to analyse whether or not discounting is domain dependent. All participants responded to six scenarios: two monetary scenarios, two environmental

scenarios, and two health scenarios. Each domain (i.e., monetary, environmental and health) included one gain and one loss scenarios.

As in previous analyses (see for example Hardisty and Weber, 2009, and Frederick, 2003), choices were made comparing an immediate option *versus* another one with a 10 years-time delay. In the monetary scenarios (one gain, one loss), respondents were asked to imagine to win/have taken a lottery/loan of £10000. They had either the option of receiving/paying the amount of money immediately or with 10 years-time delay. Using a *titration* procedure, they then answered 10 binary choice questions, where they had to express their preferences over receiving/paying £10,000 immediately or ‘X’ pounds at a 10-year delay. For this and all other *titration* procedures the scale used for the binary alternatives ranged from 1.8 to 0.9 of the present value (e.g. £18,000 to £9,000)<sup>175</sup>, and was presented in an ascending order (i.e., from the smallest to the largest alternative).

Discount rates were obtained using single indifference points where respondents switched from preferring the future option to preferring the present one. In case the *titration* procedure failed to account for a switching point, single indifference points were derived from a free-response question (that followed the *titration* procedure), where they were asked to fill in the number that would have made two different options (e.g. receiving £10,000 immediately vs. receiving £\_\_\_\_\_ 10 years from now) equally attractive to them.

In the environmental scenarios (one gain, one loss) participants were asked to imagine their country’s government was planning to implement a programme to reduce (increase) urban deforestation<sup>176</sup>. The government was considering whether to implement the programme immediately with a gain (loss) of 100 trees or in 10 years-time with a different gain (loss) of ‘X’ trees. Following these questions, in addition to *titration* and free-response items, respondents received a question where they were asked to state their preferences over the choice of getting (paying) £10,000 or saving

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<sup>175</sup> This scale is slightly different from that used in Hardisty and Weber (2009) that ranges roughly from 1.6 to 0.9. However, in order to prevent confusion among respondents, integer numbers changing by steps of £1,000 (100 for environmental and health scenarios) were preferred to a scale changing by steps of £100 (or 10).

<sup>176</sup> The increase of urban deforestation here is caused by an improvement of public transport.

(losing) 100 trees immediately. As suggested by Hardisty and Weber (2009), this helped to gather additional information on how individuals valued trees relative to money.

Respondents were finally presented with hypothetical health scenarios (one gain, one loss). Here participants were asked to imagine their country's government was planning to implement a programme to prevent (favour) life mortality<sup>177</sup>. The government was considering whether to implement the programme immediately with a gain (loss) of 100 lives or in 10 years-time with a different gain (loss) of 'X' lives. Also in this case titration and free-response items were provided. Subsequently respondents chose between receiving (paying) £10,000 immediately and saving (losing) 100 lives with 10 years-time delay.

For all scenarios presented in 'SECTION 1' of the questionnaire, the timescale considered was longer than that usually taken into account in similar analyses (which ranges from few weeks to a year). This allows considering a more realistic timescale where environmental outcomes might affect individuals' utility function. As suggested by Hardisty and Weber (2009), environmental benefits and costs are in fact not realized for many years and this might influence individuals' time preferences. Furthermore, in terms of the time span, this enables a viable comparison with the second part of the questionnaire (i.e., 'SECTION 2'), where respondents were required to allocate (i.e., *match task*) the same amount of money, trees and lives across their generation, their children's generation, their grandchildren's generation and their great grandchildren's generation. Differently from previous analyses attempting to measure intergenerational time preferences (see e.g. Cropper et al. 1994, Johannesson and Johannsson, 1997, and Frederick, 2003), this study did not force respondents to choose between equitable/inequitable programs, but allowed them to design the program that better reflected their own preferences. As shown by Frederick (2003), different elicitation methods can yield different results. Therefore this part of the questionnaire was considered as a robust test for results obtained in the previous part of the questionnaire. Even in the presence of other relevant factors (such as uncertainty), and irrespective of the framing of the question at hand, in both

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<sup>177</sup> Life mortality here increases due to an expansion of manufacturing industries.

sections of the questionnaire respondents were expected to exert similar time preferences regarding their own generation<sup>178</sup>.

In order to make sure that respondents completed the questionnaire, it was decided to split ‘SECTION 2’ in a way that gains and losses were randomly assigned to participants using two different questionnaires (i.e., Questionnaire A, and Questionnaire B) in a between subject design. By contrast, ‘SECTION 3’ of each questionnaire was common to all individuals. Here general information about respondents (i.e., gender, and year of degree programme), as well as their level of environmental morale, were collected. To this end, the same set of questions used in the survey described in chapter 3, were employed. The questionnaires are reproduced in Appendix 6A. Results are discussed separately for each section of the questionnaire in the following two paragraphs.

## 6.4 ENVIRONMENTAL MORALE AND DISCOUNTING

### 6.4.1 Methodology

The titration methodology and free-response measures used in ‘SECTION 1’ of the questionnaire served to compute a single indifference point for each scenario considered into the analysis. For comparisons with previous analyses (see Hardisty and Weber, 2009), mean discount parameters were obtained rearranging the hyperbolic discounting formula as follows:

$$r = \left( \frac{FV}{PV} - 1 \right) / D, \quad (6.1)$$

where  $PV$  represents the present value of future outcomes ( $FV$ ),  $r$  is the discount rate and  $D$  the delay (in unit of time/years). Given its simplicity this model is generally supported in the literature and it has been commonly used in similar analyses (see e.g. Hardisty and Weber, 2009).

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<sup>178</sup> The time horizon for a generation is generally considered 25 years (see e.g. Frederick, 2003).

In order to compare mean discount rates across experimental conditions (e.g. valence, domain, and environmental morale) paired-samples *t*-tests (for within-subjects design) and independent-samples *t*-tests (for between-subjects design) were employed. These tests are based on the idea that if the experimental condition had no effect (i.e.,  $H_0$  is true), the average discount rate would not change from condition to condition – i.e.,  $H_0 = \mu_1 - \mu_2 = 0$ , where  $\mu_1, \mu_2$  represent the mean discount rates in conditions 1 and 2<sup>179</sup>. Moreover, depending on the context, within-subjects (repeated-measures), and mixed analysis of variance (ANOVA) were also used to test the source of variability in these sets of measurements.

Likewise *t*-tests, analysis of variance deals with differences between and among sample means. However, no restrictions are imposed on the number of group means compared and more than one independent variable can be considered into the analysis. Overall, this reduces the chance of a Type I error<sup>180</sup>, thus resulting in one of the main advantages of using ANOVA designs. In general, the analysis of variance is built on an underlying model, where the dependent variable scores represent the data, the experimental conditions build up the model and the source of variability not accounted in the model is captured by a random error term. The main objective of the analysis of variance is to explore whether the mean dependent variable scores obtained by the manipulation of the experimental conditions differ significantly. This is achieved by establishing how much variation in the dependent variable scores is associated to differences in the scores of the experimental conditions and comparing this variation with the random error term, which provides a measure of the deviation of the dependent variable scores from the mean of each experimental condition<sup>181</sup>.

Given the differences in assumptions and hypotheses testing used in repeated measure and mixed ANOVA designs, each model will be discussed in details in Appendix 6B. However, it is relevant to note here that one of the main assumptions of ANOVA and *t*-tests is that the dependent variable scores are normally distributed. In this study, a detailed analysis of the data revealed that the distributions of discount

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<sup>179</sup> For a detailed discussion of these methodologies see Blalock (1979), and Howell (2013).

<sup>180</sup> Type I errors occur when rejecting a true null hypothesis.

<sup>181</sup> For a detailed discussion of the analysis of variance see e.g. Rutherford (2001), and Cardinal and Aitken (2006).

rates were positively skewed (absolute values  $\geq 1.91$ ) and leptokurtic (absolute values  $\geq 2.11$ ). Unfortunately, data transformations using the square or cube<sup>182</sup> of the observed data did not reduce departures from normality. Despite these considerations, given the large sample sizes ( $> 30$  for each group considered into the analysis), it was decided to use parametric rather than non-parametric analyses on the untransformed data<sup>183</sup>.

## 6.4.2 Results

### 6.4.2.1 Is discounting domain and/or valence dependent?

Mean discount parameters for each of the six scenarios in ‘SECTION 1’ of the questionnaires<sup>184</sup> are presented in Figure 6.2 below. In general, respondents discounted gains more than losses (see also Table 6.1), and discounted environmental gains and losses more than monetary and health gains and losses. In particular, as shown in Tables 6.1 and 6.2, participants discounted monetary gains ( $r = 0.14$ ,  $SD = 0.22$ ) more than losses ( $r = 0.04$ ,  $SD = 0.09$ ), a significant difference  $t(441) = 9.8$ ,  $p < 0.001$ , corresponding to a moderate effect size ( $d = 0.64$ ).<sup>185</sup> Thus, participants indicated that getting £10,000 now was equivalent to getting £24,000 in 10 years, whereas losing £10,000 now was roughly equivalent to losing £14,000 in 10 years.

In the same line, participants discounted tree gains ( $r = 0.18$ ,  $SD = 0.29$ ) more than losses ( $r = 0.05$ ,  $SD = 0.19$ ),  $t(441) = 8.9$ ,  $p < 0.001$ , and they discounted human life gains ( $r = 0.13$ ,  $SD = 0.28$ ) more than losses ( $r = 0.05$ ,  $SD = 0.18$ ),  $t(441) = 7.0$ ,  $p < 0.001$ . Specifically, respondents stated that they would prefer to save 277 trees in 10 years’ time to 100 trees today, but would prefer to lose only 154 trees in 10 years’ time to an immediate loss of 100 trees. Similarly, they revealed that saving 231 lives in 10 years’ time was preferable to saving 100 lives today, though

<sup>182</sup> Natural log, inverse and square root transformations were not possible with this set of data.

<sup>183</sup> When using large samples sizes ANOVAs,  $t$ -tests and Pearson correlations are generally robust to the violation of the assumption of normality (see Martin and Bateson, 1986, Myers and Well, 1995, and Tabachnick and Fidell, 2007).

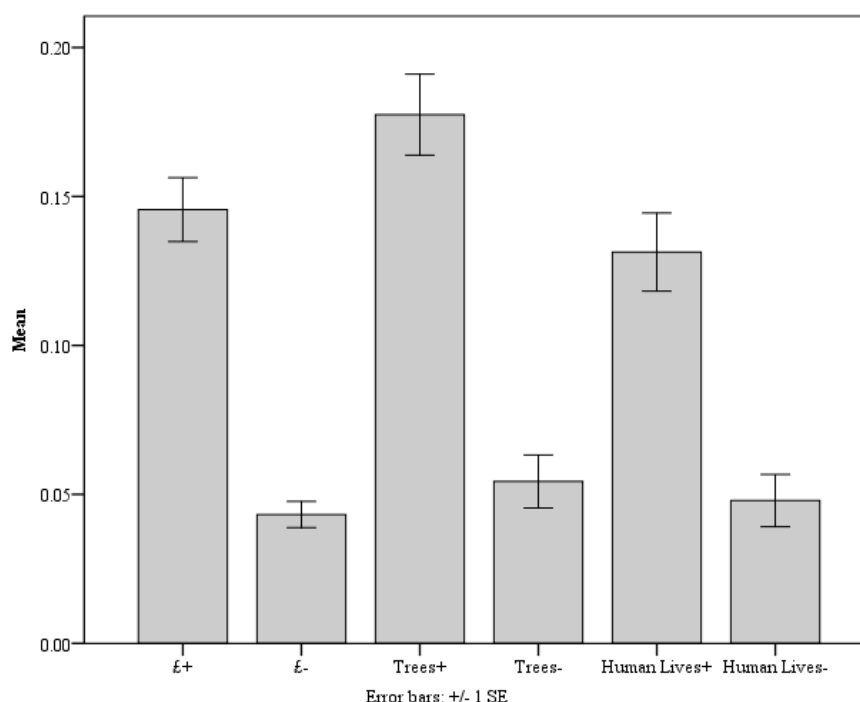
<sup>184</sup> Data here is pooled as the first part of the questionnaire was common to both questionnaires.

<sup>185</sup> Cohen’s  $d$  is generally recommended in the literature to measure effect sizes. The index quantifies the magnitude of the difference between the means of two groups. For a discussion see Howell (2013).



only a loss of 148 lives in 10 years' time was preferable to an immediate loss of 100 lives. Also in this case the differences in discounting associated with a change of valence were modest (with effect sizes respectively of  $d = 0.52$  for environmental gains and losses, and  $d = 0.36$  for the health gains and losses), but smaller than that in the monetary scenario.<sup>186</sup>

**Figure 6.2:** Mean discount parameters ( $r$ ) for monetary, environmental, and health gains (plus signs) and losses (minus signs). Error bars are  $\pm SE$  (Standard Errors)



**Table 6.1**  
Descriptive Statistics

	N	Minimum	Maximum	Mean	SD
Monetary gains	442	0.00	1.90	0.145	0.225
Monetary losses	442	-0.10	0.90	0.043	0.092
Environmental gains	442	-0.10	1.00	0.177	0.285
Environmental losses	442	-0.10	0.90	0.054	0.186
Health gains	442	-0.10	1.90	0.131	0.275
Health losses	442	-0.10	1.90	0.047	0.184

*Notes:* The table reports the total number of observations (N), the mean value (Mean), the standard deviation (SD), and the minimum/maximum value of the discount rates.

<sup>186</sup> In other words, the number of times the discount rates overlapped was higher in the environmental and health scenarios, as the percentage of discount rates' nonoverlap was on average 30%, against the 40% registered in the monetary scenario.

**Table 6.2**Paired-samples *t*-tests within domains (across valence)

<i>t</i> -tests, effect size ( <i>d</i> )	Monetary (gains/losses)	Environment (gains/losses)	Health (gains/losses)
<i>t</i> -test	9.87	8.95	7.01
<i>p</i> -value	0.000***	0.000***	0.000***
<i>d</i>	0.64	0.52	0.36

Notes: \*\*\* significant at 1% level.

Table 6.3 reports paired-samples *t*-test for differences within valence (across domains). As shown from the table, most of the pairwise comparisons for gains and losses across domains are insignificant. However, there is a significant difference in the way respondents discounted environmental gains *versus* monetary/health gains. Although not predicted, tree gains were discounted significantly more than monetary and human life gains; though the strength of the difference is relatively small in size (i.e., effect sizes range respectively from  $d = 0.1$  to  $0.2$ ).

**Table 6.3**Paired-samples *t*-tests within valence (across domains)

<i>t</i> -tests, effect size ( <i>d</i> )	Monetary vs. Environment	Monetary vs. Environment	Monetary vs. Health	Monetary vs. Health	Environment vs. Health	Environment vs. Health
	<i>gains</i>	<i>losses</i>	<i>gains</i>	<i>losses</i>	<i>gains</i>	<i>losses</i>
<i>t</i> -test	2.11	1.24	0.94	0.53	3.02	0.67
<i>p</i> -value	0.035**	0.216	0.346	0.596	0.003***	0.498
<i>d</i>	0.12	0.08	0.06	0.03	0.16	0.03

Notes: \*\*\* Significant at the 1% level, \*\* Significant at the 5% level

A 2 (valence: gains vs. losses)  $\times$  3 (domain: monetary vs. environmental vs. health) repeated-measures analysis of variance – two-way within-subjects ANOVA design – (see Appendix 6B) was used to test the hypotheses that (i.e., *Hypothesis 1*):

1. Individuals' time preferences were not influenced by valence differences. This is equivalent to the assumption that all valence means (across domain) have equal impact on the population mean;
2. Individuals' time preferences were not influenced by domain differences. That is, all domain means (across valence) have equal impact on the population mean.

3. The two factors were independent.

As shown in Table 6.4, (mean) discount rates differ statistically significantly across valence and domain ( $F(1, 441) = 155.1, p < 0.001, \eta_p^2 = 0.26$ , and  $F(2, 882) = 3.9, p < 0.05, \eta_p^2 = 0.01$ , respectively). According to Hardisty and Weber (2009) the effect of valence is stronger than that of domain. The partial eta squared,  $\eta_p^2$ , indicates that about 26% of the variation in (mean) discounting is due to the effect of valence, against 0.9% explained by domain differences<sup>187</sup>. However, results show that there is also a statistically significant interaction (although substantially small) between valence and domain, thus suggesting that the differences in valence depend upon the differences in domain,  $F(2, 882) = 3.3, p < 0.05, \eta_p^2 = 0.01$ .

**Table 6.4**

Two-way within-subjects ANOVA results

<i>Effect</i>	<i>SS<sup>a</sup></i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>p-value<sup>b</sup></i>	<i>Partial(<math>\eta^2</math>)<sup>c</sup></i>
Valence	7.031	1	7.031	155.158	0.000	0.260
Error (Valence)	19.984	441	0.045			
Domain	0.346	2	0.173	3.995	0.019	0.009
Error (Domain)	38.196	882	0.043			
Valence $\times$ Domain	0.174	2	0.087	3.378	0.034	0.008
Error (Valence $\times$ Domain)	22.719	882	0.026			
<i>Mauchly's Test of Sphericity<sup>d</sup></i>						
Valence	$\chi^2(0) = 1, p = .$					
Domain	$\chi^2(2) = 0.541, p = 0.763$					
Valence $\times$ Domain	$\chi^2(2) = 0.677, p = 0.713$					

<sup>a</sup> Type III sum of squares.

<sup>b</sup> Results are evaluated at the 5% significance level.

<sup>c</sup> Partial eta squared,  $\eta_p^2$ , is used to assess the effect size of each factor (i.e., the % of variance attributable to each factor).

<sup>d</sup> The Mauchly's Test of Sphericity is testing the null hypothesis of homogeneity of variance. A  $p$ -value  $> 0.05$  provides support for the null hypothesis.

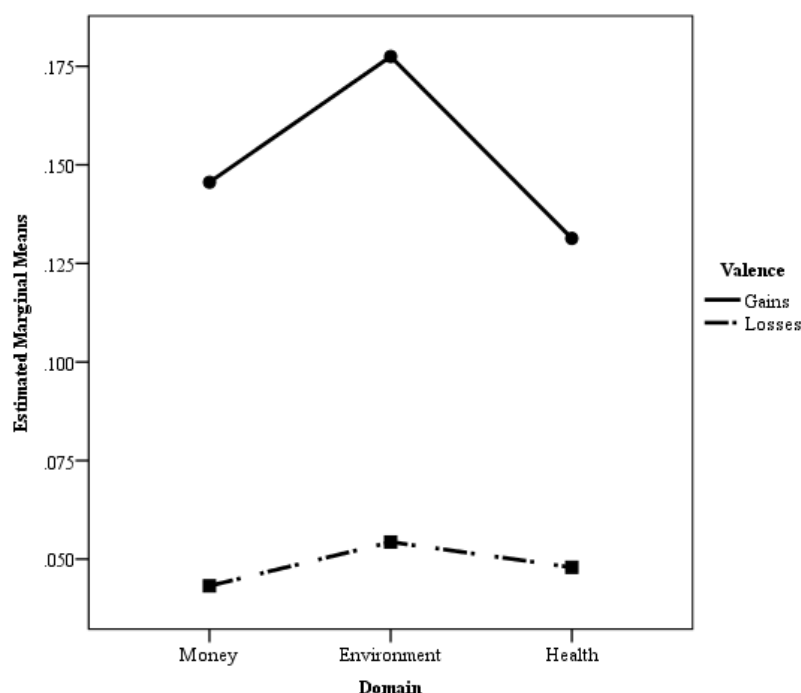
Notes: SPSS output. Within-subjects design (intercept): *valence + domain + valence\*domain*.

Figure 6.3 below provides a vivid representation of the effects of each factor and their interaction. In general, respondents discounted gains more than losses across all

<sup>187</sup> In analysis of variance, the partial eta squared,  $\eta_p^2$ , is used to assess the effect size of each experimental condition and represents the % of variation in the dependent variable attributable to each factor. For a detailed discussion about partial eta square in different ANOVA designs see Cortina and Nouri (2000).

domains. However, for environmental outcomes these differences seem to be more pronounced, especially when comparing discounting across gain scenarios<sup>188</sup>. To better understand this interaction, Table 6.5 reports simple-effects tests for the data, where the effect of valence is tested at each level of domain individually, as well as the effect of domain is tested at each level of valence individually. On the one hand, the pairwise comparisons<sup>189</sup> between domain means at each level of valence confirm that there is a statistically significant difference in the way respondents evaluate gains and losses in all domains ( $p < 0.001$  for each pair comparison). On the other hand, the pairwise comparisons between valence means at each level of domain reveal a slight increase in discounting environmental gains relative to monetary and health gains, which is statistically significant ( $p < 0.05$  for each pairwise comparison) and stronger when comparing the differences between environmental and health gains.

**Figure 6.3:** Estimated marginal means across valence and domain



<sup>188</sup> In particular, the effect of positive valence (gain scenarios) was to increase respondents' discount rates by 0.06 (i.e.,  $\alpha_1 = \mu_1 - \mu = 0.151 - 0.095$ ), while the effect of negative valence (loss scenarios), was to decrease the discount rates by 0.05 (i.e.,  $\alpha_2 = \mu_2 - \mu = 0.048 - 0.095$ ).

<sup>189</sup> Pairwise comparisons were estimated with no adjustments as, according to Cardinal and Aitken (2006), corrections are not needed when groups are  $\leq 3$  and the overall  $F$ -test from the ANOVA is significant. Results discussed here replicate therefore previous findings obtained with paired-sample  $t$ -tests.

**Table 6.5**  
Simple-effects tests (pairwise comparisons)

Domain	(I) valence	(J) valence	Mean Difference (I-J)	Std. Error	Sig. <sup>b</sup>
£	Gains	Losses	0.102*	0.010	0.000
	Losses	Gains	-0.102*	0.010	0.000
Trees	Gains	Losses	0.123*	0.014	0.000
	Losses	Gains	-0.123*	0.014	0.000
Human Lives	Gains	Losses	0.083*	0.012	0.000
	Losses	Gains	-0.083*	0.012	0.000
Valence	(I) domain	(J) domain	Mean Difference (I-J)	Std. Error	Sig. <sup>b</sup>
Gains	£	Trees	-0.032*	0.015	0.035
		Human Lives	0.014	0.015	0.346
	Trees	£	0.032*	0.015	0.035
		Human Lives	0.046*	0.015	0.003
	Human Lives	£	-0.014	0.015	0.346
		Trees	-0.046*	0.015	0.003
Losses	£	Trees	-0.011	0.009	0.216
		Human Lives	-0.005	0.009	0.596
	Trees	£	0.011	0.009	0.216
		Human Lives	0.006	0.009	0.498
	Human Lives	£	0.005	0.009	0.596
		Trees	-0.006	0.009	0.498

\* Mean differences are evaluated at the 5% significance level.

<sup>b</sup> Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

Notes: SPSS output. Tests for simple effects are based on estimated marginal means.

Although a similar trend can be observed across discount rates for loss scenarios, this is never statistically significant ( $p > 0.05$  for each pair comparison). Thus, in contrast with previous analyses (e.g. Gattig and Hendrickx, 2007), results from this survey show that environmental outcomes are discounted more relative to monetary and health outcomes, though these differences are not statistically significant for loss scenarios.

The proportion of zero and negative discounting in each domain was also computed. As in Hardisty and Weber (2009), this was done for comparisons with previous analyses that reported high rates of non-discounting for environmental

scenarios (e.g. Gattig and Hendrickx, 2007). Results show that (see proportion in parentheses) in general only few individuals exhibited zero or negative discounting for monetary (0.02), environmental (0.06), and health (0.09) gains. However, a large proportion of individuals displayed such kind of preferences for monetary (0.25), environmental (0.51), and health (0.59) losses. A similar pattern of preferences is reported in Hardisty and Weber (2009). Nevertheless, when looking at the magnitude of the calculated proportions, results from this survey indicate stronger differences between the environmental/health scenarios and the monetary scenario. In contrast with Hardisty and Weber (2009), in fact, the difference between proportions<sup>190</sup> is not only highly significant within valence (across domains,  $p_s < 0.001$ ), but also within domains (across valence,  $p_s < 0.05$  or better)<sup>191</sup>. Thus, while a small proportion of respondents was indifferent to receiving a reward immediately or in 10 years' time, or preferred to receive it later rather than now, a large number of participants were indifferent to date of receipt of losses or preferred to receive them immediately rather than later. However, these preferences were more pronounced for environmental and health scenarios. Therefore, despite results provide evidence in support of the sign effect, in line with previous analyses (see for example Chapman, 1996b, Chapman et al. 1999, and Tsukayama and Duckworth, 2010) discounting seem to be also domain dependent.

To further investigate this issue, Table 6.6 reports the correlation within domain (across valence) and within valence (across domain). As shown in the table, Pearson correlations reveal significant correlations within valence and domain supporting the conclusion that, both at the individual subject level and averaged across subjects, discounting is influenced not only by the valence of outcomes, but also by domain differences. However, as shown in the table, within-domain correlations are stronger in the monetary and health scenarios. Therefore, knowing how much an individual discounted monetary and health gains tell us more about how much that respondent

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<sup>190</sup> The difference between proportions is tested using a z-score statistics, which is defined as the difference between the (relative) proportions divided by the pooled standard deviation of the sampling distribution. For a discussion, see e.g. Blalock (1979).

<sup>191</sup> Zero and negative discounting occurred more often in response to the environmental and health outcomes than the monetary outcomes ( $p < 0.01$ ), and occurred more often for health outcomes than for environmental outcomes ( $p < 0.05$ ). However, differences between proportions were less (significantly) marked for environmental and health outcomes.

valued monetary and health losses compared to how much respondents valued environmental gains and losses.

It is interesting to note that when removing zero and negative discount rates from the analysis (see Table 6.7), the sign effect remain highly significant ( $F(1, 93) = 16.9, p < 0.001, \eta_p^2 = 0.15$ ), the domain effect approaches significance ( $F(2, 186) = 2.9, p = 0.053, \eta_p^2 = 0.03$ ), while the interaction becomes insignificant ( $F(2, 186) = 0.8, p > 0.05$ ). In particular, the effect of excluding respondents with zero or negative discounting from the analysis was to reduce the difference between discounting environmental and health outcomes (see Figure 6.4), which becomes statistically insignificant ( $p > 0.05$ ), while maintaining significant the difference in discounting environmental and monetary outcomes ( $p < 0.05$ )<sup>192</sup>.

These findings seem to suggest that differences in discounting between domains are driven by ethical concerns about future generations, which are considerably stronger for environmental and health scenarios. A far-sighted perspective assumes in fact a low (or zero) or negative rate of discounting. However, comparing Figures 6.3 and 6.4, far-sighted discounting seems to play a major role for discounting health gains rather than environmental gains. Even when including zero and negative discounting in the environmental scenario, the estimated (marginal) mean discount rate for gains remains, in fact, relatively high compared to the situation depicted in Figure 6.4. This suggests that there might be other *emotional* factors (such as impatience) that affect discounting environmental gains thus explaining the discrepancy in the results. In particular, it might be the case that individuals' evaluation of future outcomes was influenced by different levels of environmental morale and that environmental morale generated more of an affective reaction to environmentally-friendly respondents.

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<sup>192</sup> Estimated marginal means within domains were 0.12 ( $SD = 0.015$ ), 0.19 ( $SD = 0.026$ ), and 0.18 ( $SD = 0.031$ ), respectively for the monetary, environmental and health scenarios. Pairwise comparisons were estimated using Least Significant Difference (equivalent to no adjustments). Results were evaluated at the 5% significance level.

**Table 6.6**  
Pearson correlations of discount parameters

Outcome	£+	£-	Trees+	Trees-	Human Lives+	Human Lives-
£+	-					
£-	0.28***	-				
Trees+	0.25***	0.11**	-			
Trees-	0.08	0.22***	0.31***	-		
Human Lives+	0.21***	0.19**	0.35***	0.28***	-	
Human Lives-	0.20***	0.22***	0.18***	0.43***	0.47***	-

*Notes:* \*\*\* significant at the 1% level, \*\* significant at the 5% level.

**Table 6.7**  
Two-way within-subjects ANOVA results (no zero and negative discounting, N=94)

Effect	SS <sup>a</sup>	df	MS	F	p-value <sup>b</sup>	Partial( $\eta^2$ ) <sup>c</sup>
Valence	0.534	1	0.534	16.89	0.000	0.154
Error (Valence)	2.939	93	0.032			
Domain	0.432	2	0.216	2.982	0.053	0.031
Error (Domain)	13.458	186	0.072			
Valence $\times$ Domain	0.036	2	0.018	0.859	0.425	0.009
Error (Valence $\times$ Domain)	3.88	186	0.021			
<i>Mauchly's Test of Sphericity<sup>d</sup></i>						
Valence	$\chi^2(0)=1, p = .$					
Domain	$\chi^2(2)= 2.498, p = 0.287$					
Valence $\times$ Domain	$\chi^2(2)= 2.856, p = 0.24$					

<sup>a,b,c,d</sup> As in Table 6.4.

*Notes:* As in Table 6.4.

#### 6.4.2.2 Individuals' time preferences towards the environment among different levels of environmental morale

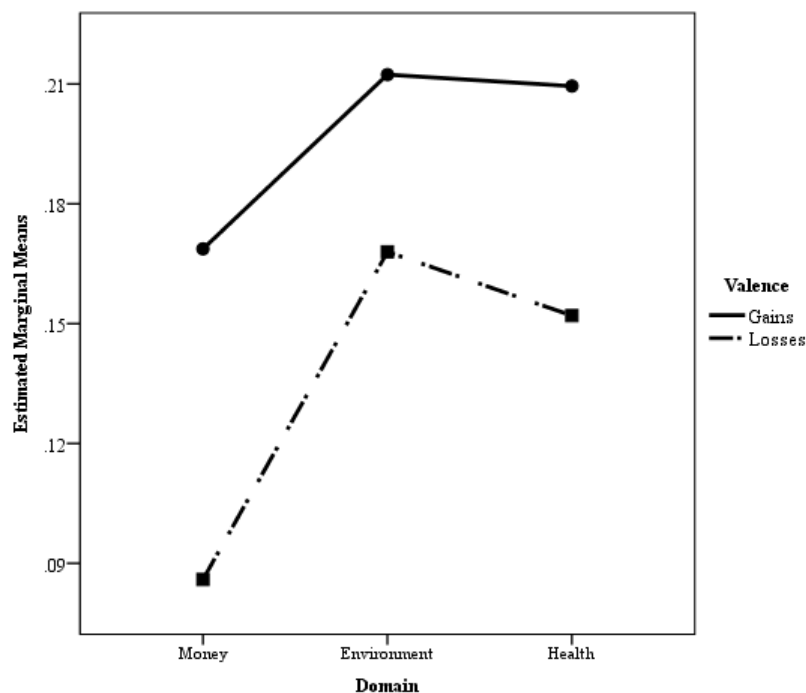
In order to investigate these issues (i.e., Hypothesis 2) and given the focus of this analysis on the role of environmental morale on discounting environmental outcomes, it was decided to split the sample between respondents with high environmental morale and low environmental morale and to run separate 2 (valence)  $\times$  3 (domain) ANOVAs for each group. As in chapter 3, the index of environmental morale (Cronbach's  $\alpha \cong 0.6$ )<sup>193</sup> was grouped in three different categories, one for low environmental morale (index score < 12), one for medium environmental morale (index score = 12), and one for high environmental morale. About 11% of

<sup>193</sup> As in chapter 3, the index appeared to have a moderate internal consistency  $\alpha = 0.598$ . All items appeared to be worth of retention except for the item used to express the willingness to buy a green product rather than a conventional one. Removal of this item increased alpha only by 0.04. However, the lower correlation of this item with the others suggested removing this item from the index measurement – i.e., the 'Corrected Item-Total Correlation' provided a Pearson correlation of 0.227.



respondents (i.e., 48) exhibited low environmental morale, 6% showed medium environmental morale (i.e., 27), while the majority of participants, 83% (i.e., 367), displayed high environmental morale. Given the small sample size of respondents with medium environmental morale, it was decided to group their responses with those reported by respondents with high environmental morale and to compare them with those obtained from respondents with low environmental morale. This not only allows us to control for problems related to departure from normality (thus providing more robust results); but also to make a clear cut point between low environmental morale (i.e., those who stated they never or rarely undertook pro-environmental behaviour for environmental reasons), and medium/high environmental morale (i.e., those who stated they sometimes, often or always undertook environmentally-friendly behaviours for environmental reasons).

**Figure 6.4:** Estimated marginal means across valence and domain (excluding zero and negative discounting)



As predicted, results show that when accounting for different levels of environmental morale, there is a substantial difference in the way individuals discount environmental outcomes with respect to other domains. Considering the

sub-set of individuals with medium/high environmental morale, Table 6.8 shows that (mean) discount parameters differ statistically significantly across valence  $F(1, 393) = 141.4, p < 0.001, \eta_p^2 = 0.26$ , and domain  $F(2, 786) = 3.3, p < 0.05, \eta_p^2 = 0.01$ . In addition, there is a significant interaction between valence and domain  $F(2, 786) = 5.1, p < 0.001, \eta_p^2 = 0.01$ .

**Table 6.8**

Two-way within-subjects ANOVA results (sub-set: medium/high environmental morale)

<i>Effect</i>	<i>SS<sup>a</sup></i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>p-value<sup>b</sup></i>	<i>Partial(<math>\eta^2</math>)<sup>c</sup></i>
Valence	6.152	1	6.152	141.492	0.000	0.265
Error (Valence)	17.088	393	0.043			
Domain	0.268	2	0.134	3.360	0.035	0.008
Error (Domain)	31.391	786	0.040			
Valence $\times$ Domain	0.253	2	0.126	5.134	0.006	0.013
Error (Valence $\times$ Domain)	19.349	786	0.025			
<i>Mauchly's Test of Sphericity<sup>d</sup></i>						
Valence	$\chi^2(0) = 1, p = .$					
Domain	$\chi^2(2) = 0.530, p = 0.767$					
Valence $\times$ Domain	$\chi^2(2) = 1.597, p = 0.450$					

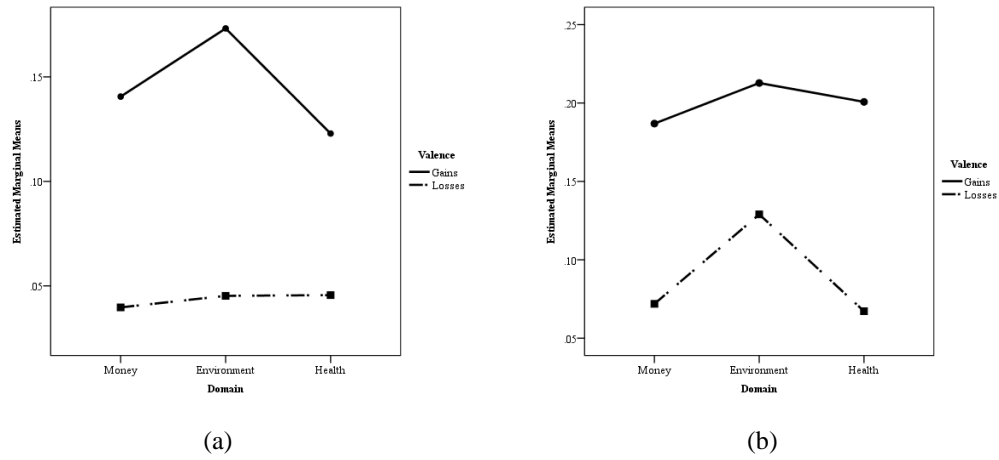
<sup>a,b,c,d</sup> As in Table 6.4.

Notes: As in Table 6.4.

Likewise the pooled sample, graphical analysis (see Figure 6.5a) and post hoc pairwise comparisons (see Table 6.9) reveal that respondents discounted gains more than losses in all domains ( $p < 0.001$  for each pair comparison of valence across domains). Again, environmental gains were discounted significantly more than monetary and health gains, with a stronger effect resulting from the comparison between environmental and health gains. By contrast, although monetary losses were discounted slightly less than environmental and health losses, there are no significant differences between estimated marginal means across domains ( $p > 0.05$ )<sup>194</sup>.

<sup>194</sup> These results remain robust even when restricting the analysis to the sub-set of individuals with high environmental morale.

**Figure 6.5:** Estimated marginal means across valence and domain.



*Notes:* Part (a) of the figure reports data from the sub-set of individuals with medium/high environmental morale; part (b) represents that of low environmental morale.

A different pattern of preferences is found among those who exhibited low environmental morale. In this context, valence (see Table 6.10) had the stronger effect on discounting,  $F(1, 47) = 14.3$ ,  $p < 0.001$ ,  $\eta_p^2 = 0.23$ , relative to domains,  $F(2, 94) = 0.6$ ,  $p > 0.05$ , and their interaction,  $F(2, 94) = 0.4$ ,  $p > 0.05$ . Figure 6.5 (b) and post hoc comparisons (see Table 6.11) indicate, in fact, that participants generally discounted monetary, environmental (not statistically significant) and health gains more than losses. Furthermore, it is interesting to note that, although low environmental morale led individuals to discount environmental losses more than monetary and health losses, differences within domain (across valence) were never statistically significant (see Table 6.11).

**Table 6.9**

Simple-effects tests (pairwise comparisons – sub-set: medium/high environmental morale)

domain	(I) valence	(J) valence	Mean Difference (I-J)	Std. Error	Sig. <sup>b</sup>
£	Gains	Losses	0.101*	0.011	0.000
	Losses	Gains	-0.101*	0.011	0.000
Trees	Gains	Losses	0.128*	0.014	0.000
	Losses	Gains	-0.128*	0.014	0.000
Human Lives	Gains	Losses	0.077*	0.012	0.000
	Losses	Gains	-0.077*	0.012	0.000
valence	(I) domain	(J) domain	Mean Difference (I-J)	Std. Error	Sig. <sup>b</sup>
Gains	£	Trees	-0.033*	0.016	0.047
		Human Lives	0.018	0.015	0.246
	Trees	£	0.033*	0.016	0.047
		Human Lives	0.050*	0.016	0.001
	Human Lives	£	-0.018	0.015	0.246
		Trees	-0.050*	0.016	0.001
Losses	£	Trees	-0.006	0.008	0.511
		Human Lives	-0.006	0.009	0.520
	Trees	£	0.006	0.008	0.511
		Human Lives	0.000	0.009	0.971
	Human Lives	£	0.006	0.009	0.520
		Trees	-0.000	0.009	0.971

\*<sup>b</sup> As in Table 6.5.Notes: As in Table 6.5.**Table 6.10**

Two-way within-subjects ANOVA results (sub-set: low environmental morale)

Effect	SS <sup>a</sup>	df	MS	F	p-value <sup>b</sup>	Partial( $\eta^2$ ) <sup>c</sup>
Valence	0.884	1	0.884	14.368	0.000	0.234
Error (Valence)	2.891	47	0.062			
Domain	0.099	2	0.050	0.688	0.505	0.014
Error (Domain)	6.783	94	0.072			
Valence × Domain	0.030	2	0.015	0.437	0.647	0.009
Error (Valence × Domain)	3.261	94	0.035			
<i>Mauchly's Test of Sphericity<sup>d</sup></i>						
Valence	$\chi^2(0) = 1, p = .$					
Domain	$\chi^2(2) = 2.742, p = 0.254$					
Valence × Domain	$\chi^2(2) = 4.503, p = 0.105$					

<sup>a,b,c,d</sup> As in Table 6.4.Notes: As in Table 6.4.

**Table 6.11**

Simple-effects tests (pairwise comparisons – sub-set: low environmental morale)

Domain	(I) valence	(J) valence	Mean Difference (I-J)	Std. Error	Sig. <sup>b</sup>
£	Gains	Losses	0.115*	0.040	0.006
	Losses	Gains	-0.115*	0.040	0.006
Trees	Gains	Losses	0.084	0.044	0.061
	Losses	Gains	-0.084	0.044	0.061
Human Lives	Gains	Losses	0.134*	0.044	0.004
	Losses	Gains	-0.134*	0.044	0.004
valence	(I) domain	(J) domain	Mean Difference (I-J)	Std. Error	Sig. <sup>b</sup>
Gains	£	Trees	-0.026	0.036	0.471
		Human Lives	-0.014	0.062	0.823
	Trees	£	0.026	0.036	0.471
		Human Lives	0.012	0.059	0.840
	Human Lives	£	0.014	0.062	0.823
		Trees	-0.012	0.059	0.840
Losses	£	Trees	-0.057	0.045	0.214
		Human Lives	0.005	0.034	0.890
	Trees	£	0.057	0.045	0.214
		Human Lives	0.062	0.040	0.127
	Human Lives	£	-0.005	0.034	0.890
		Trees	-0.062	0.040	0.127

\*<sup>b</sup> As in Table 6.5.Notes: As in Tables 6.5.

The main lesson to be drawn from the discussion above outlined is provided by Table 6.12. The table summarizes the level of impatience experienced by respondents within domains (across valence) – i.e., the vertical distance of (marginal) mean discount parameters derived – within domain (across valence) – from the full and split models above analysed (see also Figures 6.3 and 6.5)<sup>195</sup>. This provides a measure of the ‘irrational’ disutility of waiting to get something immediately. The figures reported in Table 6.12 suggest that, being less environmentally-friendly translates into heavily discounting (i.e., short-sighted preferences) environmental outcomes (i.e., impatience = 0.08), compared to other outcomes (i.e., money and

<sup>195</sup> Differences in the sub-set of respondents with high environmental morale do not differ much from the full sample as the majority of respondents in the full model exhibited high environmental morale.

health). By contrast, high environmental morale led respondents to be more impatient for environmental outcomes (i.e., impatience = 0.13).

Therefore, rather than a rational, reasoned discounting process which would predict a uniform (lower) discount rate for gains and losses, high environmental morale enhanced more of an affective response in participants. Present bias translates, in fact, into a higher discount rate for gains, and lower discount rate for losses. However, results show also that, compared to those with low environmental morale, in general environmentally-friendly respondents discounted gains and losses at a lower rate, meaning that they were less willing than them to receive gains immediately and to postpone losses to future generations. Recall that with hyperbolic discounting, positive time preferences means that the decision maker prefers to receive gains immediately rather than later and prefer to experience losses later rather than immediately. A possible explanation for this pattern of preferences can be that for environmentally-friendly respondents the desire to get gains now and losses out of the way immediately was offset by ethical concerns about future generations, thus resulting in a lower discount rate. In other words, in both the gain and loss scenarios the deliberative system might have mitigated emotional inputs towards the environment.

**Table 12**  
Impatience across domains

Domain/Model	Full	High EM	Low EM
Money	0.10	0.10	0.12
Environment	0.12	0.13	0.08
Health	0.08	0.08	0.13

*Notes:* Full = full sample of respondents, High EM = sub-sample of individuals with medium/high environmental morale, Low EM = sub-sample of individuals with low environmental morale.

#### ***6.4.2.3 The connection between environmental morale and discounting***

To further investigate the linkage between environmental morale and discounting in the environmental domain, a two-way mixed<sup>196</sup> factorial ANOVA design (see Appendix 6B) was also run, whereby different levels of environmental morale were used as a between-subjects factor and discount rates across valence as a within-

<sup>196</sup> This model is also referred in the literature as a *split plot design* (see Maxwell and Delaney, 1990).

subjects factor. As it was previously done, responses from participants with medium and high environmental morale were grouped and compared to those obtained by respondents with low environmental morale. The mixed factorial design was employed to test the hypotheses (i.e., *Hypothesis 3*) that:

1. Individuals' time preferences were not influenced by different levels of environmental morale;
2. Individuals' time preferences were not influenced by valence differences;
3. The two factors were independent.

However, having established the relevance of valence for environmental outcomes (as well as for other domains), the analysis here focused on assessing whether environmentally-friendly respondents discounted (on average) significantly less than those with lower environmental morale, and whether different levels of environmental morale affected individuals' discounting among gains and losses.

Results reported in Table 6.13 confirm a significant main effect of valence,  $F(1, 440) = 22.9, p < 0.001, \eta_p^2 = 0.05$ . However, the effect of environmental morale is not statistically significant,  $F(1, 440) = 4.4, p > 0.01$ <sup>197</sup>, and different levels of environmental morale seem not to affect statistically significantly the different way in which people discounted environmental gains and losses,  $F(1, 440) = 0.9, p > 0.05$ <sup>198</sup>.

Nevertheless, data shows (see Figure 6.6) that generally respondents with low environmental morale discounted environmental outcomes more than those with high environmental morale.

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<sup>197</sup> The Levene's test of equality of error variance suggested unequal variances across groups of individuals with different environmental morale in the loss scenario ( $p < 0.001$ ). Therefore two additional tests, i.e., the Welch and Brown-Forsythe tests, were conducted to check the robustness of this violation. Although both tests approached significance,  $F(1, 51) = 3.8, p = 0.054$ , in order to err in the side of caution, it was decided to be more conservative and to reject inequality of means across different levels of environmental morale.

<sup>198</sup> Similar conclusions were reached even when considering the three groups (i.e., low, medium, and high) of environmental morale separately.

**Table 6.13**

Two-way mixed factorial ANOVA results

<i>Effect</i>	<i>SS<sup>a</sup></i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>p-value<sup>b</sup></i>	<i>Partial(η<sup>2</sup>)<sup>c</sup></i>
Between-subjects (S):						
Environmental morale	0.325	1	0.325	4.384	0.037	0.01
Error (S/Environmental morale)	32.65	440	0.074			
Within-subjects:						
Valence	0.959	1	0.959	22.933	0.000	0.05
Valence × Environmental morale	0.042	1	0.042	0.995	0.319	0.002
Error (Valence × S/Environmental morale)	18.403	440	0.042			
<i>Mauchly's Test of Sphericity<sup>d</sup></i>						
Valence	$\chi^2(0)=1, p=.$					
<i>Levene's Test of Equality of Error Variance<sup>e</sup></i>						
Environmental Gains	$F(1, 440)=2.381, p=0.124$					
Environmental Losses	$F(1, 440)=26.838, p=0.000$					

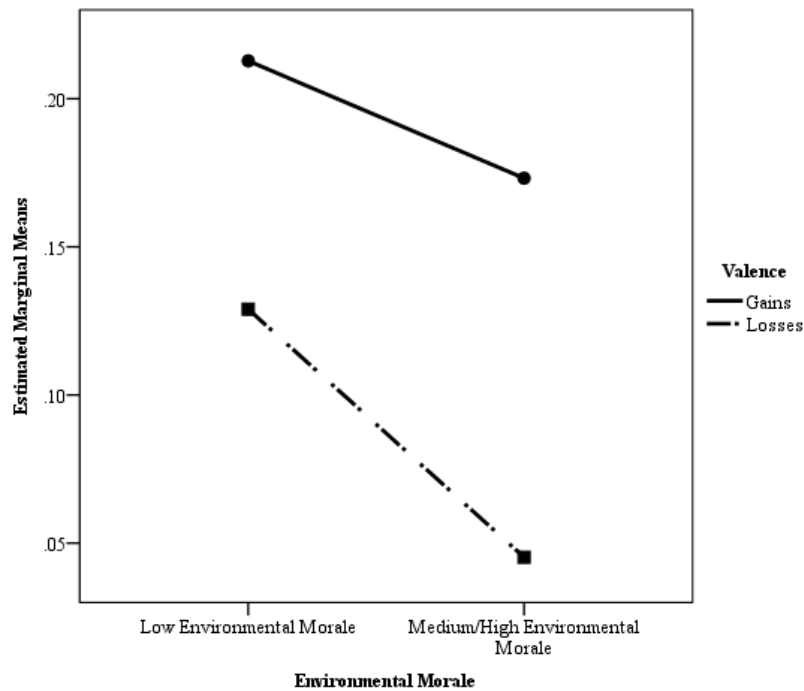
<sup>a</sup> Type III sum of squares.<sup>b</sup> Results are evaluated at the 5% significance level.<sup>c</sup> Partial eta squared,  $\eta^2$ , is used to assess the effect size of each factor (i.e., the % of variance attributable to each factor).<sup>d</sup> The Mauchly's Test of Sphericity is testing the null hypothesis of homogeneity of variance. A p-value  $> 0.05$  provides support for the null hypothesis.<sup>e</sup> The Levene's Test of Equality of Error Variances tests the null hypothesis that the error variance of the dependent variable is equal across groups of different environmental morale. A p-value  $> 0.05$  provides support for the null hypothesis.*Notes:* SPSS output. Design: *intercept + environmental morale*. Within-subjects Design: *valence*

Again, a possible explanation for this might be that ethical considerations such as social justice and equity were stronger among those with high environmental morale, which translates into higher discount rates for those with low environmental morale as they might care less about future generations. The figure provides also further evidence that affective responses were stronger among those with high environmental morale. Indeed, the difference between discount rates within valence is significantly more marked among those who exhibited high environmental morale ( $t(366) = 8.8, p < 0.001, d = 0.57$ ) than those with low environmental morale ( $t(47) = 1.9, p < 0.1, d = 0.28$ )<sup>199</sup>.

<sup>199</sup> The Pearson's correlation coefficient between discount rates within valence is respectively 0.50 and 0.26 ( $ps < 0.001$ ) for those with low environmental morale and those with high environmental morale.



**Figure 6.6:** Estimated marginal means across valence and environmental morale (domain = Environment).



Therefore, it is possible to conclude that, although affective responses were stronger among environmentally-friendly respondents<sup>200</sup>, overall they discounted environmental outcomes at a lower rate compared to less environmentally respondents. Unfortunately, the heavily *unbalanced* nature of the sample sizes prevents us to provide enough support for this conclusion. Indeed, increasing the number of individuals with low environmental morale might help reducing the

<sup>200</sup> If compared with those with low environmental morale, people with high environmental morale are more impatient for environmental gains, while discounting environmental losses at a significant lower rate.

variability of discounting in the loss scenario, thus leading to more robust conclusions. But this remains a matter of future research<sup>201</sup>.

#### **6.4.2.4 Money versus environmental and health outcomes**

As in Hardisty and Weber (2009), to see how individuals valued environmental and health outcomes relative to money, their preferences over the choice of gaining (losing) £10,000 or saving (losing) 100 trees/lives immediately was also analysed. Only 6% of respondents said they would prefer saving the trees immediately over receiving £10,000, while 8% said they would rather pay £10,000 immediately than losing 100 trees. Despite these respondents represented only a small proportion of the total sample size<sup>202</sup>, it is interesting to note that these preferences were expressed only by individuals with high environmental morale<sup>203</sup>. Therefore, nonmonetary outcomes of the environmental scenarios were valued more than monetary outcomes of the financial scenarios (the gain or payment of £10,000) only by environmentally-friendly respondents.

Regarding the health outcomes, just as 86% of respondents preferred to save 100 lives immediately rather than receiving £10,000, so too 83% preferred paying £10,000 immediately over losing 100 lives. The differences between these proportions seem to suggest that loss aversion (i.e., the idea that a loss hurts more

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<sup>201</sup> In order to circumvent this problem, it was also decided to dichotomize the environmental morale scores at the median (i.e., 15). However, the problem of heterogeneity of variance was not solved even when using a different cut point. Furthermore, given that part of the information about respondents were lost (i.e., part of the respondents who stated they undertook pro-environmental behaviours at a medium or higher level were bunched into the group of those who were never or rarely contributing to pro-environmental activities), results discussed in this section remained robust only for the sub-sample of respondents with medium/high environmental morale. Indeed, though the pattern of preferences of those with low environmental morale were similar to that above discussed, impatience was slightly stronger for environmental goods even when considering the sub-sample of individuals with low environmental morale. Therefore, according to previous analyses (see e.g. Tsukayama and Duckworth, 2010), it was decided to maintain the splitting point at the midpoint of the scale (i.e., 12) as, from a theoretical point of view, this represents the middle response (i.e., the sum of the mid-point category - 3 = sometimes - of each single item forming the EM index).

<sup>202</sup> These proportions are considerably different in magnitude from those reported by Hardisty and Weber (2009). However, the small proportions reported in this survey can be attributed to other potential confounding factors that are not controlled in this analysis, e.g. the magnitude of the monetary loss, which is significantly smaller in the Hardisty-Weber study (i.e., \$ 250).

<sup>203</sup> 93% of the individuals that stated they would prefer saving the trees immediately over the choice of receiving £10,000 exhibited high environmental morale. Similarly, 89% of those who stated they would prefer losing £10,000 immediately rather than losing 100 trees, had high environmental morale. The percentages are calculated including individuals with medium environmental morale.

than a gain of the same magnitude)<sup>204</sup> is stronger for the environmental scenario than for the health scenario. However, the percentage of respondents willing to give up money to gain nonmonetary goods is greater in the health scenario than in the environmental scenario. This result seems to be at odds with affective-preferences for environmental outcomes among respondents with high environmental morale. It was expected, in fact, that those who exhibited high environmental morale would have been more willing to sacrifice their money to get a better environment. However, this result can be due either to the idiosyncratic nature of the hypothetical scenarios, which makes the environmental outcomes less hurtful compared to the health ones, or to the fact that, although respondents were environmentally-friendly, the relative weights (i.e., prices) they assigned to trees were lower compared to those assigned to lives. As a consequence, when answering this question, health outcomes might have generated a more visceral reaction to respondents. Unfortunately, the present analysis cannot disentangle these aspects, thus leaving this question to further research.

#### ***6.4.2.5 The effect of gender and year of degree on discounting***

Entering gender as a between-subjects factor into the two-way repeated measures ANOVA designs (i.e., full sample of respondents and split samples according to individuals' level of environmental morale)<sup>205</sup> does not significantly change the pattern of preferences above discussed (see Tables 6C.1-6C.3 and Figure 6C.1 in Appendix 6C). However, although gender had no significant effect on discounting, an unexpected *Valence*  $\times$  *Gender* interaction was found significant both in the full sample,  $F(1, 440) = 5.7, p < 0.05, \eta_p^2 = 0.01$ , and in the sub-sample of individuals with low environmental morale,  $F(1, 46) = 6.2, p < 0.05, \eta_p^2 = 0.12$ , showing that, irrespective of gender characteristics, respondents discounted gains more than losses, though the effect is stronger for females. Furthermore, pairwise comparisons show that, in the sub-sample of people with low environmental morale, males

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<sup>204</sup> See Tversky and Kahneman (1992).

<sup>205</sup> The model represents a one between-subjects factor/two within-subjects factors ANOVA design. In principle, this is a modified version of the one between-subjects and one within-subjects ANOVA design above described. For a detailed description of the model, see e.g. Maxwell and Delaney (1990), and Cardinal and Aitken (2006).

discounted losses at a significant higher rate than females ( $p < 0.05$ )<sup>206</sup>. This can be related not only to gender differences towards risk aversion, but also to differences in individuals' level of environmental morale. According to results obtained in chapter 4, females seem to exhibit higher environmental morale. If this is the case, it is possible to expect a significant interaction between gender differences and different levels of environmental morale. In order to test this hypothesis, gender was entered as an additional between-subjects factor in the two-way mixed factorial ANOVA design above discussed<sup>207</sup>. Again, results described earlier remain robust when entering gender into the analysis. Although, the main effects of gender, environmental morale and their interaction had no impact on discounting (see Table 6C.4 and Figure 6C.2 in Appendix 6C), results confirm a significant interaction between valence and gender,  $F(1, 438) = 9.2, p < 0.001, \eta^2 = 0.02$  (with males discounting in general losses more than females,  $p < 0.05$ )<sup>208</sup>, and, according to expectations, a *Valence*  $\times$  *Gender*  $\times$  *Environmental Morale* interaction ( $F(1, 438) = 3.9, p < 0.05, \eta^2 = 0.01$ ) was also found significant. For the latter, pairwise comparisons suggest that: males with low environmental morale discounted losses at a significant higher rate than that of females with the same characteristics ( $p < 0.05$ )<sup>209</sup>; irrespective of the level of environmental morale females discounted gains significantly more than losses ( $p < 0.01$ )<sup>210</sup>, whereas only males with high environmental morale discounted gains significantly more than losses ( $p < 0.001$ )<sup>211</sup>; and finally, males with low environmental morale reported on average a significant

<sup>206</sup> In the sub-sample of individuals with low environmental morale, estimated marginal means for loss discount rates of males and females were respectively 0.115 ( $SD = 0.026$ ), and 0.03 ( $SD = 0.047$ ). These and the following pairwise comparisons were computed using Least Significant Difference (equivalent to no adjustments). Results were evaluated at the 5% significance level.

<sup>207</sup> The model represents a two between-subjects factor/one within-subjects factors ANOVA design. Again, the model can be viewed as a modified version of the one between-subjects and one within-subjects ANOVA design. For a detailed description of the model, see e.g. Maxwell and Delaney (1990), and Cardinal and Aitken (2006).

<sup>208</sup> Estimated marginal means for loss discount rates of males and females were respectively 0.110 ( $SD = 0.016$ ), and 0.018 ( $SD = 0.029$ ).

<sup>209</sup> Estimated marginal means for loss discount rates of males and females with low environmental morale were respectively 0.167 ( $SD = 0.030$ ), and 0.001 ( $SD = 0.056$ ).

<sup>210</sup> However, the effect was stronger among those with low environmental morale. Estimated marginal means for gains and losses for those with low environmental morale were respectively 0.284 ( $SD = 0.086$ ) and 0.001 ( $SD = 0.056$ ), vs. 0.195 ( $SD = 0.023$ ) and 0.035 ( $SD = 0.015$ ) of those with high environmental morale.

<sup>211</sup> Estimated marginal means for gains and losses among those with high environmental morale were respectively 0.158 ( $SD = 0.019$ ) and 0.052 ( $SD = 0.012$ ).

higher discount rate compared to those with high environmental morale ( $p < 0.001$ )

<sup>212</sup>.

In summary, although gender differences had no direct impact on discounting, results from this survey suggest that individuals' attitudes towards discounting seem also to be driven by gender differences and, in particular, by the interaction between environmental morale and gender. This supports the conclusion that people have different sensitiveness towards the environment, and, in line with other areas of research, results strengthen the argument that, irrespective of their level of environmental morale, males behave more in their self-interest than females as they appear to be less environmentally-friendly.

By contrast, entering year of degree as a between-subjects factor into the ANOVA designs discussed earlier had neither significant effect on discounting, nor a statistically significant interaction with all other factors (see Appendix 6D). Therefore, differences in discounting cannot be related to different levels of indoctrination into economics. It is worth emphasizing here that, despite respondents were trained in net present value computations (at least second and third year students), their preferences were long way away from the 'right' option of discounting monetary gains more than other outcomes. This not only contradicts previous results obtained using a similar sample of students (see Guyse et al., 2002), but confutes also the idea that, in this context, 'this population may not be representative of the general public' (see Hardisty and Weber, 2009, p. 330). Individuals' differences on discounting, in fact, seem to be driven more by differences in their level of environmental morale than by other possible relevant factors (e.g. indoctrination into economics).

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<sup>212</sup> Estimated marginal means of loss discount rates for males with low and high environmental morale were respectively 0.167 ( $SD = 0.030$ ) and 0.052 ( $SD = 0.012$ ).

## 6.5 ENVIRONMENTAL MORALE AND INTERGENERATIONAL PREFERENCES

### 6.5.1 Methodology

As far as intergenerational distribution of preferences is concerned; individuals' preferences were initially converted into proportions of welfare (i.e., proportion of money, trees, and lives) assigned to each generation for analysis of variance. Unfortunately, data was not only not-normally distributed, but problems arose also due to the violation of the homogeneity of variance assumption. The latter, in some cases, affected the significance level of the between-subjects factors included into the analyses, thus leading to misleading results. Unfortunately, none of the possible transformations (i.e. square and cube transformations) helped reducing these problems. Therefore, it was decided to analyse data using cross-tabulation as the best alternative solution.

Looking at the framing of the questions, respondents were allowed to choose among four different options: they could either decide to allocate all outcomes to their own generation/great grandchildren's generation (coded respectively 1 and 4 for contingency analysis), or to evenly/unevenly spread the outcomes among different generations (coded respectively 2 and 3 for the analysis). These options were aggregated into a scale that served as the dependent variable (= Choice) for contingency (i.e. cross tabulation) analysis. Results are discussed below.

### 6.5.2 Results

The proportion of responses is reported in Table 6.14. In general the table shows significant differences in the distribution of intergenerational preferences within valence (across domains). The Pearson chi-square ( $\chi^2$ ) tests on the mutual independence of choices between domains is highly significant both in the gain scenarios ( $\chi^2(6)=47.42, p=0.000$ ) and in the loss scenarios ( $\chi^2(6)=172.79, p=0.000$ ).

In the gain scenarios, 54.8% of respondents chose to spread money across generations, whereas a substantial proportion of them preferred to allocate environmental and health outcomes to their own generation (47% and 52.9% of respondents, respectively). In general, equity concerns were stronger in the health domain compared to the other two domains. About 21% of respondents chose, in fact, to evenly allocate the 100 lives to be saved across generations, against 10.9% and 3.6% of respondents who respectively did so in the environmental and health domains<sup>213</sup>. Data reveals that only a small proportion of respondents chose to allocate all gains to their great grandchildren's generation (none in the monetary domain, 0.5% in the health domain, and 2.3% in the environmental domain), whereas a substantial part of individuals chose to spread gains across generations (54.8% vs. 39.8% vs. 25.3% in the monetary, environmental, and health domains respectively).

**Table 6.14**

Cross-tabulation: Valence  $\times$  Choice  $\times$  Domain

Valence	Choice	Domain			
		Money	Environment	Health	Total
Gains	FG	1.60%	47.10%	52.90%	47.20%
	ESG	3.60%	7.70%	16.70%	9.40%
	SG	54.80%	43.00%	29.90%	42.50%
	GGG	0.00%	2.30%	0.50%	0.90%
	Total	100%	100%	100%	100%
Pearson chi-square $\chi^2(6) = 47.42, p = 0.000^a$					
	Choice	Money	Environment	Health	Total
Losses	FG	56.60%	15.80%	15.40%	29.30%
	ESG	0.90%	29.40%	34.40%	21.60%
	SG	37.10%	37.60%	29.90%	34.80%
	GGG	5.40%	17.20%	20.40%	14.30%
	Total	100%	100%	100%	100%
Pearson chi-square $\chi^2(6) = 172.79, p = 0.000^b$					
Total Pearson chi-square $\chi^2(6) = 138.82, p = 0.000^c$					

<sup>a</sup> 3 cells (25.0%) have expected count less than 5. The minimum expected count is 2.00.

<sup>b</sup> 0 cells (0.0%) have expected count less than 5. The minimum expected count is 31.67.

<sup>c</sup> 0 cells (0.0%) have expected count less than 5. The minimum expected count is 33.67.

**Notes:** FG = All allocated to first generation, ESG = Evenly spread across generations, SG = Spread across generations, GGG = All allocated to great grandchildren's generation.

<sup>213</sup> Note that in contrast with Benartzi and Thaler (2001), respondents here were not naïve in the allocation of goods among generations. In fact, there is no presence of '1/n heuristic', which would predict that someone using this rule would simply diversify evenly over the  $n$  options offered in the scenario.

In the loss scenarios (see Table 6.14), 56.6% of respondents preferred to incur monetary losses in their own generation, whereas a substantial proportion of them preferred to unevenly/evenly spread environmental/health losses across generations (i.e. 37.6% and 34.4%, respectively). In general, looking at the distribution of preferences, major differences can be observed between monetary and environmental/health losses, whereas differences are less pronounced between the environmental and health domains.

When controlling for the effect of valence as an additional layer in the cross-tabulation analysis, the overall Pearson chi-square test is also significant,  $\chi^2(6)=138.82, p=0.000$ , thus suggesting a possible interaction between the three variables. However, given the presence of sampling zeros<sup>214</sup> and small observed count in some cells of the gain scenarios, in order to check the robustness of these results, a multi-way frequency analysis (MFA) was also applied. Sampling zeros and small observed count generate, in fact, small expected frequencies that might bias upwards the Pearson chi-square test (thus inflating Type I error rates).

MFA is a nonparametric test that allows exploring interactions between discrete variables. Multi-way frequency analysis represents a simplified version of log-linear analysis<sup>215</sup>, whereby a modelling procedure is used to check for associations within variables and to come up with a model that best predicts the observed cell frequencies using the smallest number of association to do so. MFA and log-linear analysis have the advantage of allowing for a conservative correction on zero (and nonzero) frequencies by adding a value of 0.5 to every cell in the body of the table, thus providing empirical estimates of the population frequencies even in the absence of empirical instances.

MFA is based on likelihood ratio tests. As with the Pearson chi-square  $(\chi^2)$  tests, likelihood ratio tests analyse the mutual independence of discrete variables using a comparison between observed and expected frequencies. Interactions are generally

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<sup>214</sup> Sampling zeros represent zero entries in cross-tabulated tables.

<sup>215</sup> Log-linear analysis has a direct parallel with ANOVA. However, the two methodologies differ on several grounds. For a detailed description of log-linear analysis, its advantages and limitations see Knoke and Burke (1980), Bishop et al. (1995), Howell (2002), and Howell (2013).



tested by looking at the goodness of fit of a model that contains only the lower order effects. A ‘bad fit’ of the model results in a significant likelihood ratio ( $LR\chi^2$ ) test and/or Pearson chi-square, thus suggesting that the interaction must be included into the model to fit the data.

Therefore, in order to test whether or not there was an interaction between valence, domain and the choices of respondents, a likelihood ratio test was performed on a model that included all two-way interactions and the corresponding main factor effects. Results confirm that there is a significant interaction between the three variables,  $LR\chi^2(6) = 70.45$ ,  $p = 0.000$ <sup>216</sup>, meaning that the effect of domain on the choice of a specific distribution significantly depends on valence and *vice versa*<sup>217</sup>.

Having established the relationship between these variables, data was further disaggregated across different levels of environmental morale to explore whether or not environmental morale had an impact on respondents’ distribution of intergenerational preferences. Following previous sections, respondents were grouped into those who exhibited medium/high environmental morale (index score  $\geq 12$ ) and those with low environmental morale (index score  $< 12$ )<sup>218</sup>. In general, results (see Table 6.15) show that respondents revealed different preferences within valence (across different levels of environmental morale) and within different levels of environmental morale (across valence). Within valence (across different levels of environmental morale), relative frequencies show that, compared to those with high environmental morale (38.40% and 51.20%, respectively), in the gain scenarios, respondents with low environmental morale were more likely to allocate monetary and health gains to their own generation (77.8% and 72.2%, respectively). By contrast, 47.8% of respondents with high environmental morale preferred to allocate

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<sup>216</sup> Results are reported for the four options considered in the analysis. However, they remain robust even when excluding category 4 (= All allocated to great grandchildren generation).

<sup>217</sup> A similar result was also obtained using a hierarchical log-linear analysis with backward elimination. Both tests are computed assuming that the choice count is conditional on the total sample size resulting in a Multinomial distribution.

<sup>218</sup> In the gain scenarios 8% of respondents had low environmental morale, while 92% of them exhibited medium/high environmental morale. In the loss scenarios 13% of respondents had low environmental morale, while 86% of respondents had medium/high environmental morale.

trees to their own generation, against 38.9% of respondents who did so among those with low environmental morale. Minor differences can be observed in the loss scenarios, where, irrespective of their level of environmental morale, respondents preferred to face monetary losses immediately, while postponing tree and life losses to future generations.

**Table 6.15**

Cross-tabulation: Valence × Environmental Morale (EM) × Choice × Domain

		<i>Domain</i>				
<i>Valence</i>	<i>EM</i>	<i>Choice</i>	<i>Money</i>	<i>Environment</i>	<i>Health</i>	<i>Total</i>
Gains	Low EM	FG	77.80%	38.90%	72.20%	63.00%
		ESG	0.00%	11.10%	16.70%	9.30%
		SG	22.20%	33.30%	11.10%	22.20%
		GGG	0.00%	16.70%	0.00%	5.60%
	Total		100%	100%	100%	100%
Pearson chi-square $\chi^2(6) = 13.32, p = 0.038^{a,e}$						
		<i>Choice</i>	<i>Money</i>	<i>Environment</i>	<i>Health</i>	<i>Total</i>
	High EM	FG	38.40%	47.80%	51.20%	45.80%
		ESG	3.90%	7.40%	16.70%	9.40%
		SG	57.60%	43.80%	31.50%	44.30%
		GGG	0.00%	1.00%	0.50%	0.50%
	Total		100%	100%	100%	100%
Pearson chi-square $\chi^2(6) = 40.56, p = 0.000^b$						
		<i>Choice</i>	<i>Money</i>	<i>Environment</i>	<i>Health</i>	<i>Total</i>
Losses	Low EM	FG	60.00%	16.70%	0.00%	25.60%
		ESG	0.00%	13.30%	33.30%	38.90%
		SG	33.30%	50.00%	33.30%	38.90%
		GGG	6.70%	20.00%	33.30%	20.00%
	Total		100%	100%	100%	100%
Pearson chi-square $\chi^2(6) = 40.14, p = 0.000^c$						
		<i>Choice</i>	<i>Money</i>	<i>Environment</i>	<i>Health</i>	<i>Total</i>
	High EM	FG	56.00%	15.70%	17.80%	29.80%
		ESG	1.00%	31.90%	34.60%	22.50%
		SG	37.70%	35.60%	29.30%	34.20%
		GGG	5.20%	16.80%	18.30%	13.40%
	Total		100%	100%	100%	100%
Pearson chi-square $\chi^2(6) = 141.50, p = 0.000^d$						

<sup>a</sup> 9 cells (75.0%) have expected count less than 5. The minimum expected count is 1.00.

<sup>b</sup> 3 cells (25.0%) have expected count less than 5. The minimum expected count is 1.00.

<sup>c</sup> 3 cells (25.0%) have expected count less than 5. The minimum expected count is 4.67.

<sup>d</sup> 0 cells (0.0%) have expected count less than 5. The minimum expected count is 25.67.

<sup>e</sup> The Pearson chi-square tests for total sub-set of observations are not reported as they are equal to those reported in Table 6.14.

*Notes:* As in Table 6.14.

Within different levels of environmental morale (across valence), respondents with high environmental morale (see Table 6.15) were more likely to save trees and lives (47.8% and 51.2%, respectively) than getting all money (38.4%) in their own generation.

By contrast, in the loss scenarios the situation is almost reversed as the majority of respondents were more willing to repay a loan (56%) immediately than incurring environmental and health losses (15.7% and 17.8%, respectively). Minor differences can be observed for those with low environmental morale, where, irrespective of valence, respondents preferred to face monetary gains and losses in their own generation compared to the other two outcomes.

As shown in Table 6.15 all Pearson chi-square tests are significant at the 5% level (or better). However, results here need to be treated with caution. Indeed, in cross-tabulation analysis, the inevitable drawback of further disaggregating data among variables is to increase the number of sampling zeros and small observed (and expected) frequencies. This problem is also exacerbated here by the small sample size of respondents with low environmental (across valence)<sup>219</sup>. As stated above, this reduces the power of the Pearson chi-square tests thus leading to misleading conclusions. However, a possible alternative to test whether or not the observed cell frequencies of the variable ‘Choice’ were due to the interaction between environmental morale, valence and domain, was to collapse choices into a small number of categories.

The distribution of preferences above summarized suggests, in fact, that major differences occurred over the choice of allocating all outcomes to the first generation *versus* all other options. Therefore, in order to simplify the analysis, two types of choice were considered: one accounting for the option ‘All allocated to the first generation’ and the second one considering all other alternatives (i.e., evenly/unevenly distribution of outcomes across generations, and all allocated to great grandchildren generation). Both the (overall) Pearson chi-square test

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<sup>219</sup> A possible solution to the problem, which is left to future research, is to increase the sample size sufficiently to remove all zero cells.

$(\chi^2(2) = 33.79, p = 0.000)^{220}$ , and the likelihood ratio test  $(LR\chi^2(2) = 11.07, p = 0.004)$  were significant, thus suggesting a statistical significant interaction between the four variables.

However, the fact that this relationship was statistically significant did not help much explaining the size of the effect of environmental morale. Odds ratios were therefore computed to compare the odds of choosing to allocate the outcomes to the first generation within valence (across different levels of environmental morale) and within different strata of environmental morale (across valence). Odds ratios (reported in Table 6.16) were obtained as follows (see Howell, 2013):

$$OR = \frac{n_{11k} n_{22k} / n_{.k}}{n_{12k} n_{21k} / n_{.k}}, \quad (6.2)$$

where  $n$  represents the number of observations falling into each cell of the table, and subscripts are used to distinguish different conditions over several strata<sup>221</sup>. In general odds can be interpreted as follows. The closer the odds value is to 1, the more balanced the relative odds are. Values below 1 and close to 0, are also referred as odds-against or less likely to occur. Finally, odds above the unity are more likely (than not) to occur.

Unfortunately, even when collapsing choice categories into a small number of categories, one cell in the health domain displayed a sampling zero. Therefore, it was not possible to compute the odds ratio for that particular scenario. As shown in the table, compared to those with low environmental morale, in the gain scenarios people with high environmental morale were more impatient for environmental goods. Indeed, the odds of choosing to allocate all trees to the first generation (FG) were stronger than those for the other two goods (i.e., 1.44). By contrast, differences in preferences across different levels of environmental morale were less pronounced in

<sup>220</sup> The overall Pearson chi-square and those related to each sub-sample of frequencies were computed with zero cells having expected frequencies less than 5.

<sup>221</sup> To give an example, relative to those with low environmental morale, the odds ratio of choosing to allocate all money to the first generation if having high environmental morale (i.e., 0.18) is given by the ratio of the odds of choosing FG if individuals exhibited high environmental morale (i.e.,  $78/125 = 0.624$ ), and the odds of doing so if they exhibited low environmental morale (i.e.,  $14/4 = 3.5$ ).

the loss scenarios as the computed odds ratios are generally close to one, meaning that, the odds of choosing to allocate all outcomes to the first generation were similar across different levels of environmental morale, especially for the environmental scenario. Similarly, among those with high environmental morale, the odds of choosing FG in the gain scenarios were about five times of what they were in the loss scenarios. Although a similar pattern of preferences can be observed among those with low environmental morale, the effect is generally stronger among environmentally-friendly respondents.

**Table 6.16**

Distribution of choices across domains and levels of environmental morale (EM)

<i>Gains</i>						
Domain	High EM		Low EM		Total	Odds ratio
	FG	OO	FG	OO		
Money	78	125	14	4	221	0.18
Environment	97	106	7	11	221	1.44
Health	104	99	13	5	221	0.40
Total	279	330	34	20	663	
<i>Losses</i>						
Domain	High EM		Low EM		Total	Odds ratio
	FG	OO	FG	OO		
Money	107	84	18	12	221	0.85
Environment	30	161	5	25	221	0.93
Health	34	157	0	30	221	-
Total	171	402	23	67	663	
<i>High EM</i>						
Domain	Gains		Losses		Total	Odds ratio
	FG	OO	FG	OO		
Money	78	125	107	84	394	0.49
Environment	97	106	30	161	394	4.91
Health	104	99	34	157	394	4.85
Total	279	330	171	402	1182	
<i>Low EM</i>						
Domain	Gains		Losses		Total	Odds ratio
	FG	OO	FG	OO		
Money	14	4	18	12	48	2.33
Environment	7	11	5	25	48	3.18
Health	13	5	0	30	48	-
Total	34	20	23	67	144	

*Notes:* FG = All allocated to first generation, OO = All other options.

A vivid representation of the discussion above outlined as well as of the results reported in Table 6.15 is provided in Figure 6.7. As shown in the figure, relative to monetary outcomes, environmentally-friendly respondents were more impatient to experience environmental and health gains than monetary gains, and less patient to experience monetary losses immediately compared to environmental and health losses. A different pattern of preferences occurred among people who exhibited low environmental morale, indicating that the variable matters. For the low environmental morale category impatience was stronger for monetary gains and losses, and patience prevailed among environmental and health outcomes.

**Figure 6.7:** Impatience and distributional preferences across different levels of environmental morale (EM).

		High EM		
		Environment	Health	Money
Gains	Now	Now		Spread
		<i>Impatient</i>		<i>Patient</i>
Losses	Spread	Spread		Now
		<i>Patient</i>		<i>Impatient</i>

		Low EM		
		Environment	Health	Money
Gains	Spread	Spread		Now
		<i>Patient</i>		<i>Impatient</i>
Losses	Spread	Spread		Now
		<i>Patient</i>		<i>Impatient</i>

*Notes:* The table summarises respondents' preferences over the allocation of different goods (i.e., monetary, environmental and health outcomes) among generations. In the table, 'Now' represents respondents' disposition to allocate the good to their own generation, whereas 'Spread' indicates their tendency to share the good with other generations. These preferences are accordingly regarded as impatient (=now) and patient (=spread) behaviours among participants.

These findings suggest that valence as well as domain had a significant effect on the distribution of intergenerational preferences. Furthermore, depending on the context, according to their level of environmental morale, individuals exhibited different sensitiveness towards different goods. However, as shown in Figure 6.7, differences were less pronounced among *intangibles*<sup>222</sup>. What was different about

<sup>222</sup> This result seems to be in line with neuroeconomics research (see Baddeley, 2013), which, in contrast to neoclassical economics, suggests that money can be viewed as an end in itself (i.e., money has its own utility) and not just as a means to an end (i.e., goods and services).

*intangibles*? In line with what suggested by Shogren et al. (1994) resolving differences in willingness to accept (WTA) and willingness to pay (WTP), possible explanation for this relies on the imperfect substitutability of intangible and tangible goods. Environmental and health outcomes cannot be perfectly exchanged for money, markets for these goods are incomplete and benefits and/or damages are irreversible. Therefore although people can make choices about them, they are generally not fully compensated for losses. This not only might create a discrepancy in evaluating nontradable and tradable goods, but can also lead individuals to exhibit a higher willingness to accept gains in their own generation, while postponing losses ahead. According with Shogren et al. (ibid) the lower the degree of substitutability with money, the higher the WTA-WTP discrepancy is.

Apart from this, in general, more similarities can be found between health and environmental outcomes than between environmental and monetary outcomes. As suggested by Hardisty and Weber (2009), though difficult to quantify, for example, environmental changes always impact health. As stated in the questionnaire, in addition to abating air and water pollution; trees absorb carbon dioxide, which contributes to climate change and therefore to human lives.

As far as discounting is concerned; the distribution of choice preferences provides further evidence into the argument that, environmentally-friendly people seem to discount environmental gains and losses more than monetary gains and losses (see also Figure 6.5 above).

A recent reconceptualization of the *fixed-cost* present bias theory (see Hardisty et al., 2012), might help explaining these results. According to Hardisty et. al. (ibid), time preferences can be explained by the interaction between the psychological desire to resolve gains and losses soon (i.e., present bias motive), the desire to avoid feelings of deprivation/dread while waiting (see e.g. Hoch and Loewenstein, 1991) and many other factors (such as uncertainty, resource slack, opportunity cost, social norms and ideals). In line with their predictions, positive and high discount rates for environmental gains can be explained, for example, by the interaction between the desire of avoiding feelings of deprivation (of trees), uncertainty over the occurrence of future gains, and the present bias motive. All these motives follow the same

direction and reinforce each other and might explain why, in general, respondents preferred above all to save trees in their own generation. By contrast, for environmental losses the willingness to resolve things as soon as possible might be offset by the negative utility derived from anticipating losses (as environmentally-friendly people like the environment), and, for example, by the fact that, if losses are postponed, respondents may never have to deal with them (or delayed losses may never be realized). This ultimately results in a lower (but positive) discount rate for environmental losses (i.e. higher willingness to spread losses among generations in comparison with monetary losses). What was different about monetary outcomes? The psychological desire to satisfy impatience for monetary outcomes might be relatively unimportant not only compared with other factors (such as social norms and ideals)<sup>223</sup>, but also compared with that experienced by environmentally-friendly people for the environment, thus discounting monetary gains and losses less than environmental gains and losses.

Regarding the apparent discrepancy between discounting and intergenerational preferences of health versus monetary outcomes, this might be due to the large number of zero discounting reported in the first part of the questionnaire attributable to that part of respondents who did not complete the second section of the questionnaire for the gain scenarios (see also Figure 6.4 above)<sup>224</sup>. Similar arguments may apply when comparing intergenerational preferences and discounting for those who exhibited low environmental morale.

## 6.6 CONCLUSIONS

Given the scarce empirical research directly exploring differences in discounting for different goods, this chapter analyses discounting of (and intergenerational preferences for) monetary, environmental and health outcomes. The major objectives

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<sup>223</sup> Social norms and ideals (see Hardisty et al., 2012) can lead individuals to delay gratification (e.g. feelings of altruism towards other generations) and to attend losses immediately (e.g. people might feel irresponsible to ignore fiscal obligations that will be faced by future generations). These motives can explain why respondents preferred above all to spread monetary gains and experience monetary losses immediately (i.e. negative discounting).

<sup>224</sup> Recall that only a proportion of respondents who participated to the first part of the survey completed also the second part.



of the analysis were to investigate whether *intangibles* like environmental outcomes may be discounted differently from other outcomes and whether environmental morale might play a role in evaluating environmental costs and benefits, an area that has been neglected in the literature. To this end, a survey investigation was conducted at the University of Bath (UK) among first, second and third year students exposed to economics training. Discount rates and intergenerational preferences were obtained using respectively a *titration* procedure and a *match task* where respondents were allowed to allocate the goods across generations.

Contrary to Hardisty and Weber (2009), results from this survey suggest that discounting is valence and domain dependent (*Hypothesis 1*), meaning that differences in discounting within valence depend upon domain differences. Although the effect of valence appeared to be stronger than that of domain, the effect of domain and their interaction also played a role in explaining differences in individuals' discounting. Therefore, the present research not only corroborates previous findings that temporal discounting is domain dependent (see e.g. Chapman, 1996b, and Tsukayama and Duckworth, 2010), but also provides a possible explanation for these results. In particular, the empirical analysis suggest that different sensitiveness towards the environment (i.e., different levels of environmental morale) partially explains differences in discounting within domain (across valence) and within valence (across domains) – i.e., *Hypothesis 3*. Thus, an individual can be more impatient for environmental outcomes (i.e., he/she has a high discount rate for environmental gains, but a low discount rate for losses), and can discount environmental gains more than monetary and health gains, in part, because they are environmentally-friendly (i.e., they act in a more eco-conscious way) – i.e. *Hypothesis 2*. This motivates them to evaluate environmental goods differently from other types of goods and to discount them accordingly. However, differences were in general less pronounced among *intangibles*. The incompleteness of markets (i.e., lack of substitutability with money) and the mutual interdependency between health and the environment might have created a more visceral reaction in respondents, who tended to treat them similarly.

These findings remained generally robust even when changing the framing of the questions (i.e., in the match task), whereby results confirmed the presence of the sign and domain effects and impatience for environmental outcomes was stronger among individuals with high environmental morale.

This said, it is also important to acknowledge that in contrast to other studies (see e.g. Hardisty and Weber, 2009), this analysis does not control for potential confounding factors (e.g. the order of the questions, the scale of the titration procedure, inclusion of adults into the sample population, and the use of different scenarios) which might affect the robustness of the results. Furthermore, in some cases, the unbalanced nature of the sample sizes to an extent undermined the strength of the conclusions. All these aspects remain matters of future research.

Despite these considerations, results from this survey may offer guidance to policy makers hoping to encourage future-oriented environmental sustainability. As suggested by the present analysis, irrespective of valence, environmental outcomes are evaluated differently from other tradable and non-tradable goods, though differences are less pronounced among intangibles (i.e., environmental and health goods). The fact that people exhibited different rates of pure time preference for different goods (significantly different for gains, insignificantly different for losses) seems to suggest the adoption of different discount rates when dealing with consumption goods and when handling with environmental goods.

These findings are in line with some of the arguments in support of the dual discounting approach (see Sáez and Requena, 2007, and Almansa and Martínez-Paz, 2011). According to Almansa and Martínez-Paz (2011, p. 688) one of the theoretical reason for applying the dual-rate discounting it that ‘since environmental goods are not market goods, individuals have different mindsets and act differently when dealing with ‘merchandise’ and when dealing with ‘environmental goods’.’

However, in contrast with other studies (see e.g., Luckert and Admowicz, 1993, Tylor et al., 2003, and Gattling and Hendrickx, 2007), even among environmentally-friendly respondents, revealed preferences in the current research did not provide

evidence for lower rates of time preference for environmental goods, thus suggesting departures from the dual rate discounting. This leads to the following questions: first, what are the implications of relying on such preferences? Are these preferences feasible with the objective of maximizing environmental sustainability and social welfare? If so, what specific value should the discount rate take on? If not, is there any alternative solution?

If governments were to accept individuals' preferences as described above, the consequences for CBA will be twofold. First, the pure rate of time preference should be higher than those suggested in the literature for  $\delta$  (i.e., the Stern Review considers  $\delta = 0\%$ , while the Green Book assumes  $\delta = 0.5\%$ ), thus intimating a higher discount rate than that used in the financial market for cost benefit analysis. However, as discussed in chapter 5, this might preclude many desirable projects being undertaken even if their impacts are evaluated in the short run (i.e., 0-30 years). Kula and Evans (2011), for example, in an afforestation project appraisal in County Tyrone (Northern Ireland), show that even using a discount rate of 3.5% (as suggested by the HM Treasury, 2003), can lead to a negative net present value over a time span of 30 years.

These considerations fit into the well-known debate about whether the discount rate, and  $\delta$ , should be determined according to a descriptive approach (i.e., it should be derived from the sum of individual or government preferences) or a prescriptive approach (i.e., it should be normatively agreed with the society's objective of sustainability). Without going into details, the main argument underpinning the debate behind the two schools of thought is that the sum of individuals' preferences might differ from collective preferences (see e.g. Klassen and Opschoor, 1991, and Bürgenmeier, 1994). Indeed, according to Kula (1981, 1987) society cannot be considered as a mortal individual as it has much longer life expectancy than that of individuals. This calls for specific evaluations of project impacts to future generations. Considering a descriptive approach, a higher discount rate than that used in the financial market, will turn out into greater discrimination against future generations (see Pearce et al., 1989), thus introducing problems of intergenerational equity and justice. However, contrary to Stern (2007), the current research suggests

departures from a zero rate of pure time preference, according to which a gain/loss of 100 trees 10 years from now should be given the same value as today. This not only can realistically capture individuals' behaviour, but might also balance the welfare trade-off between the current and future generation(s) thus preventing the so called 'tyranny of the future generations' (see Harrison, 2010).

Second, irrespective of individuals' level of environmental morale, participants showed that compensation for delaying (or the willingness to pay to get) a desirable outcome (i.e., gain 100 trees) was a long way away from the premium they were willing to accept to put such an event off (i.e., lose 100 trees). Just as prospect theory (see e.g. Kahneman and Tversky, 1979) relates differences in risk attitudes towards gains and losses to a behavioural anomaly (i.e., *endowment effect*, which is the tendency to value goods that are owned by individuals more than those not held in their endowment), the discounting literature attaches this disposition to impatience for consumption now rather than later and the reverse for costs. Rational expectations would predict that, regardless of valence, two identical situations (i.e., goods) should be discounted similarly. However, observed discount rates in survey analyses and experiments (see Thaler, 1981, Frederick et al., 2002, and Hardisty et al., 2012) typically show that losses are discounted less than gains. A possible explanation for this anomaly is that individuals might not be alive to enjoy/deal with it tomorrow. The fact that risk and uncertainty over the future influence present bias preferences is well acknowledged in the literature – i.e., when considering trade-offs between two options in two future moments, stronger relative weights are assigned to the closer event in time. It turns out that individuals tend to anticipate (postpone) gains (losses) immediately rather than having them hanging over their head (see Loewenstein, 1987).

In the context of this research, impatience was unexpectedly higher among environmentally-friendly respondents. This would suggest myopic behaviour even in the presence of ethical considerations. Thus, one may conclude that, if impatience matters, economic assessment of loss will be seriously underestimated if they are evaluated in terms of gains (see also Knetsch, 1990). Too many projects will pass CBA and compensation will fail to fully indemnify adverse environmental changes

(see Cullis and Jones, 2009). However, as discussed in the empirical section, rather than a more rational discounting process which would predict a uniform (lower) rate of time preference, the irreversible nature of natural capital might have stimulated more of an affective reaction in environmentally-friendly respondents, thus exacerbating the discrepancy between discounting environmental gains and losses. Therefore, a *paradox of hyperopia* seems to be located in this data: people that have a long-sighted view discount environmental gains more than losses, but, compared to less environmentally-friendly individuals, they are less willing to postpone losses to (near and far distant) future generations. Taking these preferences, the benefits of doing something now can also be experienced by future generations, but for costs this will result in a less discriminatory practice towards future generations. Therefore, in this context, present bias preferences will be appreciated by our long-run selves as this translates into ‘benevolence of the present’ rather than the ‘tyranny of the present’ (see Koundouri, 2009).

Keeping in mind the challenging goal of environmental sustainability, the above discussion seems to suggest that government intervention is needed not only to sensitize individuals towards more eco-conscious behaviour, but also to guarantee increasing investments to ameliorate the environment as a ‘grant to future generations’. While further empirical research is needed to strengthen this conclusion, the results from this analysis envision a more paternalistic role of the government, not only to deal with environmental sustainability but also to face a relatively new actor, namely *homo realitus*.

## APPENDIX 6A: QUESTIONNAIRES

### 6A.1 QUESTIONNAIRE A

University of Bath  
Individuals' time preferences

#### Questionnaire A

The purpose of this questionnaire is to gather information on individuals' time preferences. The questionnaire is divided into three different sections. In 'SECTION 1' and 'SECTION 2' you are requested to answer questions about hypothetical scenarios regarding time preferences in different contexts. In 'SECTION 3' you are asked to provide general information about yourself and to state your opinion on particular issues.

In the questionnaire you will find questions with the following format:

*For each pair of values, please select the answer that best reflects your personal preferences.*

A.	<input type="checkbox"/>	50 apples	Or	<input type="checkbox"/>	45 apples
B.	<input type="checkbox"/>	50 apples	Or	<input type="checkbox"/>	50 apples
C.	<input type="checkbox"/>	50 apples	Or	<input type="checkbox"/>	55 apples
D.	<input type="checkbox"/>	50 apples	Or	<input type="checkbox"/>	60 apples
E.	<input type="checkbox"/>	50 apples	Or	<input type="checkbox"/>	65 apples
F.	<input type="checkbox"/>	50 apples	Or	<input type="checkbox"/>	70 apples

For these questions you are supposed to tick only ONE box for each pair of values, i.e.:

A.	<input checked="" type="checkbox"/>	50 apples	or	<input type="checkbox"/>	45 apples
B.	<input checked="" type="checkbox"/>	50 apples	or	<input type="checkbox"/>	50 apples
C.	<input type="checkbox"/>	50 apples	or	<input checked="" type="checkbox"/>	55 apples
D.	<input type="checkbox"/>	50 apples	or	<input checked="" type="checkbox"/>	60 apples
E.	<input type="checkbox"/>	50 apples	or	<input checked="" type="checkbox"/>	65 apples
F.	<input type="checkbox"/>	50 apples	or	<input checked="" type="checkbox"/>	70 apples

To answer all the other questions, please tick ONE of the boxes next to the answer(s); or, when appropriate, write your answer in the space provided.

I would be very grateful for your contribution to this study. All responses will remain anonymous. Thank you for your help. Lory Barile (lb292@bath.ac.uk).

## **SECTION 1**

**Q1) Imagine you won a lottery, worth £10,000. You have the option of either receiving the amount of money immediately or receiving a different amount of money “X” 10 years from now. Would you prefer to receive £10,000 immediately or “X” pounds 10 years from now?**

**For each pair of values, please select the answer that best reflects your personal preferences.**

- |    |  |    |  |
|----|--|----|--|
| A. | <input type="checkbox"/> £10,000 immediately | or | <input type="checkbox"/> £9,000 10 years from now  |
| B. | <input type="checkbox"/> £10,000 immediately | or | <input type="checkbox"/> £10,000 10 years from now |
| C. | <input type="checkbox"/> £10,000 immediately | or | <input type="checkbox"/> £11,000 10 years from now |
| D. | <input type="checkbox"/> £10,000 immediately | or | <input type="checkbox"/> £12,000 10 years from now |
| E. | <input type="checkbox"/> £10,000 immediately | or | <input type="checkbox"/> £13,000 10 years from now |
| F. | <input type="checkbox"/> £10,000 immediately | or | <input type="checkbox"/> £14,000 10 years from now |
| G. | <input type="checkbox"/> £10,000 immediately | or | <input type="checkbox"/> £15,000 10 years from now |
| H. | <input type="checkbox"/> £10,000 immediately | or | <input type="checkbox"/> £16,000 10 years from now |
| I. | <input type="checkbox"/> £10,000 immediately | or | <input type="checkbox"/> £17,000 10 years from now |
| J. | <input type="checkbox"/> £10,000 immediately | or | <input type="checkbox"/> £18,000 10 years from now |

**Please fill in the number that would make the following two options equally attractive to you:**

- A. Receiving £10,000 immediately.  
B. Receiving £\_\_\_\_\_ 10 years from now.

**Q2) Imagine you have taken a loan of £10,000. You have the option of either repaying the amount of money immediately or delaying your payment by returning a different amount of money “X” 10 years from now. Would you prefer to pay £10,000 immediately or “X” pounds 10 years from now?**

**For each pair of values, please select the answer that best reflects your personal preferences.**

- |    |  |    |  |
|----|--|----|--|
| A. | <input type="checkbox"/> £10,000 immediately | or | <input type="checkbox"/> £9,000 10 years from now  |
| B. | <input type="checkbox"/> £10,000 immediately | or | <input type="checkbox"/> £10,000 10 years from now |
| C. | <input type="checkbox"/> £10,000 immediately | or | <input type="checkbox"/> £11,000 10 years from now |
| D. | <input type="checkbox"/> £10,000 immediately | or | <input type="checkbox"/> £12,000 10 years from now |
| E. | <input type="checkbox"/> £10,000 immediately | or | <input type="checkbox"/> £13,000 10 years from now |
| F. | <input type="checkbox"/> £10,000 immediately | or | <input type="checkbox"/> £14,000 10 years from now |
| G. | <input type="checkbox"/> £10,000 immediately | or | <input type="checkbox"/> £15,000 10 years from now |
| H. | <input type="checkbox"/> £10,000 immediately | or | <input type="checkbox"/> £16,000 10 years from now |
| I. | <input type="checkbox"/> £10,000 immediately | or | <input type="checkbox"/> £17,000 10 years from now |
| J. | <input type="checkbox"/> £10,000 immediately | or | <input type="checkbox"/> £18,000 10 years from now |

**Please fill in the number that would make the following two options equally attractive to you:**

- A. Paying £10,000 immediately.  
B. Paying £\_\_\_\_\_ 10 years from now.

**Q3) Imagine your country's government is planning to implement a programme to reduce urban deforestation. In addition to abating air and water pollution; trees absorb carbon dioxide, which contributes to climate change. The government is considering whether to implement the programme immediately to save 100 trees, or 10 years from now to save a different number "X" of trees. Would you prefer to save 100 trees immediately or "X" trees 10 years in the future?**

**For each pair of values, please select the answer that best reflects your personal preferences.**

- |    |  |    |  |
|----|--|----|--|
| A. | <input type="checkbox"/> 100 trees immediately | or | <input type="checkbox"/> 90 trees 10 years from now  |
| B. | <input type="checkbox"/> 100 trees immediately | or | <input type="checkbox"/> 100 trees 10 years from now |
| C. | <input type="checkbox"/> 100 trees immediately | or | <input type="checkbox"/> 110 trees 10 years from now |
| D. | <input type="checkbox"/> 100 trees immediately | or | <input type="checkbox"/> 120 trees 10 years from now |
| E. | <input type="checkbox"/> 100 trees immediately | or | <input type="checkbox"/> 130 trees 10 years from now |
| F. | <input type="checkbox"/> 100 trees immediately | or | <input type="checkbox"/> 140 trees 10 years from now |
| G. | <input type="checkbox"/> 100 trees immediately | or | <input type="checkbox"/> 150 trees 10 years from now |
| H. | <input type="checkbox"/> 100 trees immediately | or | <input type="checkbox"/> 160 trees 10 years from now |
| I. | <input type="checkbox"/> 100 trees immediately | or | <input type="checkbox"/> 170 trees 10 years from now |
| J. | <input type="checkbox"/> 100 trees immediately | or | <input type="checkbox"/> 180 trees 10 years from now |

**Please fill in the number that would make the following two options equally attractive to you:**

- A. Saving 100 trees immediately.  
 B. Saving \_\_\_\_\_ trees 10 years from now.

**Would you prefer to gain £10,000 or to save 100 trees immediately?**

- A. I would prefer to gain £10,000 immediately.....☐  
 B. I would prefer to save 100 trees immediately.....☐

**Q4) Imagine your country's government wants to ameliorate public transport by implementing the construction of new railways, highways and subways. This will certainly favour connections but will also contribute to an increase of urban deforestation. The government is considering whether to implement the programme immediately with a loss of 100 trees or 10 years from now for a different loss of "X" trees. Would you prefer to lose 100 trees immediately, or "X" trees 10 years in the future?**

**For each pair of values, please select the answer that best reflects your personal preferences.**

- |    |  |    |  |
|----|--|----|--|
| A. | <input type="checkbox"/> 100 trees immediately | or | <input type="checkbox"/> 90 trees 10 years from now  |
| B. | <input type="checkbox"/> 100 trees immediately | or | <input type="checkbox"/> 100 trees 10 years from now |
| C. | <input type="checkbox"/> 100 trees immediately | or | <input type="checkbox"/> 110 trees 10 years from now |
| D. | <input type="checkbox"/> 100 trees immediately | or | <input type="checkbox"/> 120 trees 10 years from now |
| E. | <input type="checkbox"/> 100 trees immediately | or | <input type="checkbox"/> 130 trees 10 years from now |
| F. | <input type="checkbox"/> 100 trees immediately | or | <input type="checkbox"/> 140 trees 10 years from now |
| G. | <input type="checkbox"/> 100 trees immediately | or | <input type="checkbox"/> 150 trees 10 years from now |
| H. | <input type="checkbox"/> 100 trees immediately | or | <input type="checkbox"/> 160 trees 10 years from now |
| I. | <input type="checkbox"/> 100 trees immediately | or | <input type="checkbox"/> 170 trees 10 years from now |



J. ☐ 100 trees immediately or ☐ 180 trees 10 years from now

**Please fill in the number that would make the following two options equally unattractive to you:**

- A. Losing 100 trees immediately.  
B. Losing \_\_\_\_\_ trees 10 years from now.

**Would you prefer to lose £10,000 or to lose 100 trees immediately?**

- A. I would prefer to lose £10,000 immediately.....☐  
B. I would prefer to lose 100 trees immediately.....☐

**Q5) Imagine your country's government is planning to implement a programme to reduce population's mortality by providing high quality health care and promoting healthy lifestyles. The government is considering whether to implement the programme immediately to save 100 lives or 10 years from now to save a different number "X" of lives. Would you prefer to save a certain 100 lives immediately or a certain "X" lives 10 years in the future?**

**For each pair of values, please select the answer that best reflects your personal preferences.**

- |    |  |    |  |
|----|--|----|--|
| A. | <input type="checkbox"/> 100 lives immediately | or | <input type="checkbox"/> 90 lives 10 years from now  |
| B. | <input type="checkbox"/> 100 lives immediately | or | <input type="checkbox"/> 100 lives 10 years from now |
| C. | <input type="checkbox"/> 100 lives immediately | or | <input type="checkbox"/> 110 lives 10 years from now |
| D. | <input type="checkbox"/> 100 lives immediately | or | <input type="checkbox"/> 120 lives 10 years from now |
| E. | <input type="checkbox"/> 100 lives immediately | or | <input type="checkbox"/> 130 lives 10 years from now |
| F. | <input type="checkbox"/> 100 lives immediately | or | <input type="checkbox"/> 140 lives 10 years from now |
| G. | <input type="checkbox"/> 100 lives immediately | or | <input type="checkbox"/> 150 lives 10 years from now |
| H. | <input type="checkbox"/> 100 lives immediately | or | <input type="checkbox"/> 160 lives 10 years from now |
| I. | <input type="checkbox"/> 100 lives immediately | or | <input type="checkbox"/> 170 lives 10 years from now |
| J. | <input type="checkbox"/> 100 lives immediately | or | <input type="checkbox"/> 180 lives 10 years from now |

**Please fill in the number that would make the following two options equally attractive to you:**

- A. Saving 100 lives immediately.  
B. Saving \_\_\_\_\_ lives 10 years from now.

**Would you prefer to gain £10,000 or to save 100 lives immediately?**

- A. I would prefer to gain £10,000 immediately.....☐  
B. I would prefer to save 100 lives immediately.....☐

**Q6) Imagine your country's government is planning to expand manufacturing industries. This will encourage economic growth but will also increase the population's exposure to pollution and the risk of cancer deaths. The government is considering whether to implement the programme immediately with a loss of 100 lives or 10 years from now for a different loss of "X" lives. Would you prefer to lose a certain 100 lives immediately or a certain "X" lives 10 years in the future?**

**For each pair of values, please select the answer that best reflects your personal preferences.**

- |    |  |    |  |
|----|--|----|--|
| A. | <input type="checkbox"/> 100 lives immediately | or | <input type="checkbox"/> 90 lives 10 years from now  |
| B. | <input type="checkbox"/> 100 lives immediately | or | <input type="checkbox"/> 100 lives 10 years from now |
| C. | <input type="checkbox"/> 100 lives immediately | or | <input type="checkbox"/> 110 lives 10 years from now |
| D. | <input type="checkbox"/> 100 lives immediately | or | <input type="checkbox"/> 120 lives 10 years from now |
| E. | <input type="checkbox"/> 100 lives immediately | or | <input type="checkbox"/> 130 lives 10 years from now |
| F. | <input type="checkbox"/> 100 lives immediately | or | <input type="checkbox"/> 140 lives 10 years from now |
| G. | <input type="checkbox"/> 100 lives immediately | or | <input type="checkbox"/> 150 lives 10 years from now |
| H. | <input type="checkbox"/> 100 lives immediately | or | <input type="checkbox"/> 160 lives 10 years from now |
| I. | <input type="checkbox"/> 100 lives immediately | or | <input type="checkbox"/> 170 lives 10 years from now |
| J. | <input type="checkbox"/> 100 lives immediately | or | <input type="checkbox"/> 180 lives 10 years from now |

**Please fill in the number that would make the following two options equally attractive to you:**

- A. Losing 100 lives immediately.  
 B. Losing \_\_\_\_\_ lives 10 years from now.

**Would you prefer to lose £10,000 or to lose 100 lives immediately?**

- A. I would prefer to lose £10,000 immediately..... ☐  
 B. I would prefer to lose 100 lives immediately..... ☐

## **SECTION 2**

**Q7) Imagine you won a lottery, worth £10,000. You are given the opportunity of receiving the £10,000 in your generation or to allocate the £10,000 across generations.**

**Please fill in the blank the number that best reflects your personal preferences.**

I would prefer to receive £\_\_\_\_\_ in my generation, to leave £\_\_\_\_\_ to my children's generation, to leave £\_\_\_\_\_ to my grandchildren's generation, and to leave £\_\_\_\_\_ to my great grandchildren's generation.

**Q8) Imagine the government has implemented a programme to stop urban deforestation. The programme will save 100 trees. How would you allocate the 100 trees to be saved across generations?**

**Please fill in the number that best reflects your personal preferences.**

I would prefer to save \_\_\_\_\_ trees in my generation, \_\_\_\_\_ trees in my children's generation, \_\_\_\_\_ trees in my grandchildren's generation, and \_\_\_\_\_ trees in my great grandchildren's generation.

**Q9) Imagine the government has implemented a life saving programme. The programme will save 100 lives. How would you allocate the 100 lives to be saved across generations?**

**Please fill in the number that best reflects your personal preferences.**

I would prefer to save \_\_\_\_\_ lives in my generation, \_\_\_\_\_ lives in my children's

generation, \_\_\_\_\_ lives in my grandchildren's generation, and \_\_\_\_\_ lives in my great grandchildren's generation.

### **SECTION 3**

#### **Q10) Gender:**

Male..... ☐  
Female..... ☐

#### **Q11) Year of Degree Programme:**

First..... ☐  
Second..... ☐  
Third..... ☐

**Q12) Imagine you have two identical 'supermarket' type goods: one is environmentally-friendly, the other one is a conventional product. Compared to the price of the conventional good, what price would you be willing to pay to buy the environmentally-friendly item? The difference in price helps to protect the environment.**

Only the same price as the conventional good..... ☐  
10 % more than the price of the conventional good..... ☐  
20 % more than the price of the conventional good..... ☐  
30 % more than the price of the conventional good..... ☐  
More than 30% than the price of the conventional good..... ☐

#### **Q13) Please indicate how often you take each action for environmental reasons:**

a) Save water when taking a shower or brushing your teeth:

Never..... ☐  
Rarely..... ☐  
Sometimes..... ☐  
Often..... ☐  
Always..... ☐

b) Recycle:

Never..... ☐  
Rarely..... ☐  
Sometimes..... ☐  
Often..... ☐  
Always..... ☐

c) Turn off lights you are not using:

Never..... ☐  
Rarely..... ☐  
Sometimes..... ☐  
Often..... ☐

Always..... ☐

d) Walk, cycle or take public transport:

Never..... ☐

Rarely..... ☐

Sometimes..... ☐

Often..... ☐

Always..... ☐

**Thank for taking the time to complete this questionnaire!**

## **6A.2 QUESTIONNAIRE B**

Preamble, 'SECTION 1' and 'SECTION 3' as in Questionnaire A. 'SECTION 2' is presented below.

### **SECTION 2**

**Q7) Imagine you have taken a loan of £10,000. You are given the opportunity of repaying the £10,000 in your generation or to allocate the payment of £10,000 across generations.**

**Please fill in the blank the number that best reflects your personal preferences.**

I would prefer to pay £\_\_\_\_\_ in my generation, to leave £\_\_\_\_\_ to my children's generation, to leave £\_\_\_\_\_ to my grandchildren's generation, and to leave £\_\_\_\_\_ to my great grandchildren's generation.

**Q8) Imagine the government has implemented a programme to favour public transport. The programme will cause a loss of 100 trees. How would you allocate the loss of 100 trees across generations?**

**Please fill in the number that best reflects your personal preferences.**

I would prefer to lose \_\_\_\_\_ trees in my generation, \_\_\_\_\_ trees in my children's generation, \_\_\_\_\_ trees in my grandchildren's generation, and \_\_\_\_\_ trees in my great grandchildren's generation.

**Q9) Imagine the government has implemented a programme to favour manufacturing industries. The programme will cause a loss of 100 lives due to additional pollution. How would you allocate the loss of 100 lives across generations?**

**Please fill in the number that best reflects your personal preferences.**

I would prefer to lose \_\_\_\_\_ lives in my generation, \_\_\_\_\_ lives in my children's generation, \_\_\_\_\_ lives in my grandchildren's generation, and \_\_\_\_\_ lives in my great grandchildren's generation.

## APPENDIX 6B: ANOVA DESIGNS

### 6B. 1 TWO-WAY GENERAL LINEAR MODEL (GLM) ANOVA DESIGN

In a two-way ANOVA design, the structural model can be formally summarized by the following equation (see e.g. Maxwell and Delaney, 1990, and Cardinal and Aitken, 2006)<sup>225</sup>:

$$Y_{ijk} = \mu + \pi_i + \alpha_j + \beta_k + (\pi\alpha)_{ij} + (\pi\beta)_{ik} + (\alpha\beta)_{jk} + (\pi\alpha\beta)_{ijk} + \varepsilon_{ijk}, \quad (6B.1)$$

where  $Y_{ijk}$  is the dependent variable score for subject  $i$  at the  $j$ th level of Factor A (e.g., valence) and the  $k$ th level of Factor B (e.g., domain),  $\mu$  is the dependent variable score free of any influence of the experimental conditions (i.e., the grand mean)<sup>226</sup>,  $\pi_i$ ,  $\alpha_j$ , and  $\beta_k$  are respectively the random contributions of subject  $i$ , and that of the  $j$ th and  $k$ th level of Factors A and B<sup>227</sup>,  $(\pi\alpha)_{ij}$  and  $(\pi\beta)_{ik}$  are the interactions between subject  $i$  and each level of the two factors,  $(\alpha\beta)_{jk}$  is the interaction effect of the  $j$ th level of Factor A and the  $k$ th of Factor B,  $(\pi\alpha\beta)_{ijk}$  represents the contribution of the interaction of subject  $i$  with each level of the two

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<sup>225</sup> Equation (6B.1) represents a fully related (non-additive) factorial design GLM. Among other things, this model seems to be a more realistic representation of the data. In contrast with additive models, in fact, it allows subjects to interact with all variables – i.e., it assumes that different treatments may affect different subject in different way and therefore it accommodates score variance attributable to different subjects. For an explanation of the differences between additive and non-additive models, see e.g. Girden (1992), Rutherford (2001), and Cardinal and Aitken (2006).

<sup>226</sup> The grand mean can be defined as the sum of the means of each separate factor, divided by the number of levels of the factors – i.e.,  $\mu = \sum_{j=1}^p \sum_{k=1}^q \mu_{jk} / pq$ , where  $\mu_{jk}$  denotes the separate experimental

condition means, and  $p, q$  are respectively the number of levels in Factors A and B.

<sup>227</sup> That is, these terms represent the degree to which the marginal mean of conditions  $i$ ,  $j$ , and  $k$  deviates from the overall mean, where the marginal mean for each level of the factors is defined as the performance estimates under the levels of one factor, averaged over the influence of the other factor.

factors<sup>228</sup>, and  $\varepsilon_{ijk}$  is the amount by which the score of person  $i$  in conditions  $j$  and  $k$  of Factors A and B deviates from the scores predicted by the two factors GLM (i.e., a random error)<sup>229</sup>.

Equation (6B.1) summaries a system of equations, where each equation represents a single dependent variable score. ANOVA assumes that the scores of each condition are independent and normally distributed, and have the same variance (i.e., homogeneity of variance). Therefore they can only differ in their means. In order to measure the mean variation across conditions, ANOVA calculations rely on sum of squares (SS) estimations<sup>230</sup>, from which expected mean squares (MS) and  $F$ -test statistics can be computed to assess the impact of a specific factor<sup>231</sup>.

According to the model, there are seven effects to be estimated: three main factor effects, three two-way interactions ( $A \times B$ ,  $A \times S$ ,  $B \times S$ ) – where  $S$  stays for Subjects –, and one three way interaction ( $A \times B \times S$ ). However, the main objective of the model is to analyse the main effects of Factors A and B as well as their interaction. Thus, the null hypotheses to be tested are that all means (across levels and factors) are equal to each other and equal to the grand mean (i.e., all treatment effects are zero), and that there is no interaction between the two factors.

In a *balanced* two-way within-subject ANOVA the sum of squares of a particular effect can be computed from the full model described in equation (6B.1), where it is

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<sup>228</sup> Although in ANOVA GLMs the interaction term between each factor and subjects is generally captured by the  $F$ -test used to assess the main effects of Factors A and B, the term representing the interaction between subjects and the other two factors (i.e.,  $\pi\alpha\beta_{ijk}$ ) is commonly omitted (i.e., the interaction is equal to zero) as the presence of only one score per subject per experimental condition prevents its computation (see Rutherford, 2001). Therefore, it is assumed that the interaction is confounded with the error term  $\varepsilon_{ijk}$ , which can be written more accurately as  $((\pi\alpha\beta)_{ijk} + \varepsilon_{ijk})$ .

<sup>229</sup> Specifically, the error term can be defined as follows:  
 $\varepsilon_{ijk} = Y_{ijk} - \hat{Y}_{ijk} = Y_{ijk} - (\mu + \pi_i + \alpha_j + \beta_k + (\pi\alpha)_{ij} + (\pi\beta)_{ik} + (\alpha\beta)_{jk} + (\pi\alpha\beta)_{ijk})$ , where  $\hat{Y}_{ijk}$  represents the predicted scores per subject and in each experimental condition.

<sup>230</sup> The least-squares criterion is used here to minimize the errors of the predicted values of the dependent variables.

<sup>231</sup> These statistics vary across different ANOVA designs. For a comprehensive description of them see, for example, Maxwell and Delaney (1990). In this context, the sum of squares of a particular treatment can be defined as the summed squared deviations of the treatment marginal mean from the grand mean, multiplied by the total number of observations per treatment and the number of levels of the other factor.

assumed that Factors A and B are fixed factors, while S is a random factor. However, in contrast with a between-subjects design, in this case, the choice of the error term for a specific effect is dictated by the expected mean squares ( $EMS$ )<sup>232</sup> of the effects in the model, rather than by the mean square error term (which is an estimation of the population variance). This is particularly relevant for the computation of the  $F$ -test statistics, which compares the variance of the expected mean squares of each treatment with that of the error, such that:

$$F = \frac{EMS_{(treatment)}}{EMS_{(error)}}, \quad (6B.2)$$

As a general rule of thumb, the error term of an effect is chosen in a way that it differs from the expected mean square of the effect itself only from an additional term over the denominator of the  $F$ -test. In the model described by equation (6B.1), the interaction terms between a specific factor and subjects (and between all factors and subjects) can be used as an appropriate error term to test the main effects of the factors (and that of their interaction). This is because the expected mean square of a specific factor is given by the sum of the population variance, the variance attributable to the interaction between the factor and the subjects, and the variance generated by the main effect of the factor. By contrast, the expected mean square of the interaction of that particular factor with subjects differs from the expected mean square of the effect itself only in that the former does not include the variation of the main effect of the factor. Therefore, the interaction between the factor and subjects can be used as an error term for testing the factor main effect. The same considerations can also be applied to the interaction between factors (and factors and subjects).

It is worth emphasizing that, when the null hypothesis is true, the variance attributable to the main effect of the factor (or that of their interaction) is equal to zero, and  $EMS_{(treatment)} = EMS_{(error)}$ . However, if the null hypothesis is false, the  $F$ -test statistics becomes significant the more it departs from one – i.e., when

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<sup>232</sup> The expected mean squares for each effect is given by the ratio between the sum of square attributable to an effect and the degrees of freedom used to calculate the relative sum of squares.

$EMS_{(treatment)} > EMS_{(error)}$ . Table 6B.1 provides a summary of the ANOVA output as well as a description of the main statistics used to explain the results.

**Table 6B.1**

Two-way within-subjects ANOVA table

<i>Effect</i>	<i>SS</i>	<i>df</i>	<i>MS<sup>a</sup></i>	<i>F</i>
<i>Factor A</i>	$SS_A$	$(p-1)$	$MS_A$	$MS_A/MS_{A \times S}$
<i>Error (Factor A <math>\times</math> S)</i>	$SS_{A \times S}$	$(p-1)(n-1)$	$MS_{A \times S}$	
<i>Factor B</i>	$SS_B$	$(q-1)$	$MS_B$	$MS_B/MS_{B \times S}$
<i>Error (Factor B <math>\times</math> S)</i>	$SS_{B \times S}$	$(q-1)(n-1)$	$MS_{B \times S}$	
<i>Factor A <math>\times</math> B</i>	$SS_{A \times B}$	$(p-1)(q-1)$	$MS_{A \times B}$	$MS_{A \times B}/MS_{A \times B \times S}$
<i>Error (Factor A <math>\times</math> B <math>\times</math> S)</i>	$SS_{A \times B \times S}$	$(p-1)(q-1)(n-1)$	$MS_{A \times B \times S}$	

<sup>a</sup> *MS* can be also obtained by dividing the respective *SS* of the effect under consideration by its degrees of freedom.

Notes: *p* and *q* are the levels of Factors A and B, respectively. *n* is the number of subjects. *SS* represents sum of squares for specific factor effects and interactions. *df* represents the degrees of freedom used to compute *SS*. *MS* refers to expected mean squares for specific factor effects and interactions. *F* is the *F*-test statistic obtained using expected mean squares.

## 6B.2 TWO-WAY MIXED GENERAL LINEAR MODEL (GLM) ANOVA DESIGN

A two-way mixed ANOVA design can be formally written as follows (see e.g. Maxwell and Delaney, 1990, and Cardinal and Aitken, 2006):

$$Y_{ijk} = \mu + \alpha_j + \beta_k + \pi_{i(j)} + (\beta\pi)_{ki(j)} + (\alpha\beta)_{jk} + \varepsilon_{ijk}, \quad (6B.3)$$

where  $Y_{ijk}$  is the dependent variable score for subject *i* at the *jth* level of Factor A (e.g., environmental morale) and the *kth* level of Factor B (e.g., valence),  $\mu$  is the dependent variable score free of any influence of the experimental conditions (i.e., the grand mean),  $\alpha_j$  and  $\beta_k$  are respectively the random contributions of the *jth* and *kth* level of Factors A and B,  $\pi_{i(j)}$  is the contribution of subject *i* to the *jth* level of Factor A,  $(\beta\pi)_{ki(j)}$  is the effect of the interaction between the *kth* level of Factor B and the *i*th subject in the *jth* level of Factor A,  $(\alpha\beta)_{jk}$  is the interaction



effect of the  $j$ th level of Factor A and the  $k$ th level of Factor B, and  $\varepsilon_{ijk}$  is a random error term associated with measuring person  $i$  (that always experiences treatment A) in condition  $B_k$ .

This model is similar to that described in equation (6B.1). However, there is a substantial difference in the way subjects and their effects are represented into the models. Specifically, in the model described by equation (6B.3) subjects are nested under Factor A as each subject appears in only one level of A<sup>233</sup>. Therefore, differently from a two-way within-subjects design, in a mixed design it is impossible to verify whether the effect of Factor A differs across subjects. This nested effect substitutes therefore the main effect of S and its interaction with Factor A in equation (6B.1), but it does not affect Factor B<sup>234</sup>. A natural consequence of this is that rather than seven effects, there are now five effects to be analysed in the model.

The general principles described earlier for repeated measures ANOVA designs are also valid here to analyse the mean variation across conditions. The only difference occurs in the source of variability used to compute the denominator of the  $F$ -test<sup>235</sup>, which is employed to assess the significance of each factor main effect and their interaction. In this case, the  $F$ -test needs to take into account that subject variation cannot be analysed separately from Factor A. Table 6B.2 reports a summary of the ANOVA output as well as the main statistics used to obtain the results. As shown in Table 6B.2, the between-subjects variability is attributed not only to the effect of Factor A (A), but also to differences between subjects in the same group (S/A). Similarly, the within-subjects variability is attributed to either the effect of Factor B (B), or an interaction between the two factors ( $B \times A$ ), or an interaction between Factor B and the subject-to-subject variability (e.g., an effect of

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<sup>233</sup> This is indicated by the  $i(j)$  notation in equation (6B.3).

<sup>234</sup> The interaction between S and Factor B,  $(\beta\pi_{ki(j)})$ , still holds as each subject has a score at each and every level of Factor B (= valence).

<sup>235</sup> Compared to the model described in equation (6B.1), the specific expressions for sum of squares are identical for the main effects of A, B, and  $A \times B$  in a two-way within-subjects design. The only differences occur in the error terms, which are chosen following the same principles above described for repeated measures ANOVA designs. For a discussion see e.g. Maxwell and Delaney (1990).

valence that differs for each subject), which can only be measured, for example, within an environmental morale group ( $B \times S/A$ ).

**Table 6B.2**

One within-subjects factor and one between-subjects factor design ANOVA table

<i>Effect</i>	<i>SS</i>	<i>df</i>	<i>MS<sup>a</sup></i>	<i>F</i>
<i>Between-subjects (S):</i>				
<i>Factor A</i>	$SS_A$	$(a-1)$	$MS_A$	$MS_A/MS_{S/A}$
<i>Error (Factor S/A)</i>	$SS_{S/A}$	$a(n-1)$	$MS_{S/A}$	
<i>Within-subjects:</i>				
<i>Factor B</i>	$SS_B$	$(b-1)$	$MS_B$	$MS_B/MS_{S/A}$
<i>Factor B <math>\times</math> A</i>	$SS_{B \times A}$	$(a-1)(b-1)$	$MS_{B \times A}$	$MS_{B \times A}/MS_{B \times S/A}$
<i>Error (Factor B <math>\times</math> S/A)</i>	$SS_{B \times S/A}$	$a(b-1)(n-1)$	$MS_{B \times S/A}$	

<sup>a</sup> *MS* can be also obtained by dividing the respective *SS* of the effect under consideration by its degrees of freedom.

Notes: *a* and *b* are the levels of Factors A and B respectively. *n* is the number of subjects per group (per level of A). *SS* represents sum of squares for specific factor effects and interactions. *df* represents the degrees of freedom used to compute *SS*. *MS* refers to expected mean squares for specific factor effects and interactions. *F* is the *F*-test statistic obtained using expected mean squares.

## APPENDIX 6C: THE EFFECT OF GENDER ON DISCOUNTING

**Table 6C.1**

Two within-subjects factors and one between-subjects factor design ANOVA table (full model)

<i>Effect</i>	<i>SS<sup>a</sup></i>	<i>Df</i>	<i>MS</i>	<i>F</i>	<i>p-value<sup>b</sup></i>	<i>Partial(η<sup>2</sup>)<sup>c</sup></i>
Between-subjects (S):						
Gender <sup>d</sup>	0.059	1	0.059	0.574	0.449	0.001
Error (S/Gender)	45.179	440	0.103			
Within-subjects:						
Valence	7.280	1	7.28	162.401	0.000	0.270
Valence × Gender	0.260	1	0.26	5.793	0.016	0.013
Error (Valence × S/Gender)	19.724	440	0.045			
Domain	0.289	2	0.144	3.331	0.036	0.008
Domain × Gender	0.032	2	0.016	0.364	0.695	0.001
Error (Domain × S/Gender)	38.164	880	0.043			
Valence × Domain	0.226	2	0.113	4.392	0.013	0.010
Valence × Domain × Gender	0.094	2	0.047	1.834	0.160	0.004
Error (Valence × Domain × S/Gender)	22.624	880	0.026			
<i>Mauchly's Test of Sphericity<sup>e</sup></i>						
Valence	$\chi^2(0)=1, p = .$					
Domain	$\chi^2(2)=0.515, p = 0.773$					
Valence × Domain	$\chi^2(2)=0.552, p = 0.759$					
<i>Levene's Test of Equality of Error Variance<sup>f236</sup></i>						
Monetary Gains	$F(1, 440)=11.286, p = 0.001$					
Monetary Losses	$F(1, 440)=0.560, p = 0.455$					
Environmental Gains	$F(1, 440)=8.584, p = 0.004$					
Environmental Losses	$F(1, 440)=11.218, p = 0.001$					
Health Gains	$F(1, 440)=2.144, p = 0.144$					
Health Losses	$F(1, 440)=3.237, p = 0.073$					

<sup>a</sup> Type III sum of squares.

<sup>b</sup> Results are evaluated at the 5% significance level.

<sup>c</sup> Partial eta squared,  $\eta^2$ , is used to assess the effect size of each factor (i.e. the % of variance attributable to each factor).

<sup>d</sup> Gender: 271 males, and 171 females.

<sup>e</sup> The Mauchly's Test of Sphericity is testing the null hypothesis of homogeneity of variance. A p-value  $> 0.05$  provides support for the null hypothesis.

<sup>f</sup> The Levene's Test of Equality of Error Variances tests the null hypothesis that the error variance of the dependent variable is equal across males and females for different outcomes. A p-value  $> 0.05$  provides support for the null hypothesis.

<sup>236</sup> All tables reported in this Appendix show that the Levene's test of equality of variance is significant for some of the outcomes. Given the *unbalanced* nature of the between-subjects factors used in the analysis, this might create a distortion to Type I error rates (i.e., the incorrect conclusion that the between-subjects factor has a significant main effect on discounting). However, as shown in the tables, the between-subjects factors are always insignificant, thus suggesting that generally the violation of this assumption does not represent a problem (see Cardinal and Aitken, 2006, and Maxwell and Delaney, 1990).

Notes: SPSS output. Design: *intercept + gender*. Within-subjects Design: *valence + domain + valence\*domain*

**Table 6C.2**

Two within-subjects factors and one between-subjects factor design ANOVA table (sub-sample: medium/high environmental morale)

<i>Effect</i>	<i>SS<sup>a</sup></i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>p-value<sup>b</sup></i>	<i>Partial(η<sup>2</sup>)<sup>c</sup></i>
Between-subjects (S):						
Gender <sup>d</sup>	0.170	1	0.170	1.937	0.165	0.005
Error (S/Gender)	34.368	392	0.088			
Within-subjects:						
Valence	6.276	1	6.276	145.126	0.000	0.27
Valence × Gender	0.135	1	0.135	3.124	0.078	0.008
Error (Valence × S/Gender)	16.953	392	0.043			
Domain	0.321	2	0.116	2.890	0.056	0.007
Domain × Gender	0.036	2	0.018	0.451	0.637	0.001
Error (Domain × S/Gender)	31.355	784	0.040			
Valence × Domain	0.286	2	0.143	5.816	0.003	0.015
Valence × Domain × Gender	0.049	2	0.024	0.988	0.373	0.003
Error (Valence × Domain × S/Gender)	19.3	784	0.025			
<i>Mauchly's Test of Sphericity<sup>e</sup></i>						
Valence	$\chi^2(0)=1, p=.$					
Domain	$\chi^2(2)=0.535, p=0.765$					
Valence × Domain	$\chi^2(2)=1.602, p=0.449$					
<i>Levene's Test of Equality of Error Variance<sup>f</sup></i>						
Monetary Gains	$F(1, 392)=11.692, p=0.001$					
Monetary Losses	$F(1, 392)=3.033, p=0.082$					
Environmental Gains	$F(1, 392)=8.088, p=0.005$					
Environmental Losses	$F(1, 392)=2.935, p=0.087$					
Health Gains	$F(1, 392)=4.965, p=0.026$					
Health Losses	$F(1, 392)=8.39, p=0.004$					

<sup>a,b,c,e,f</sup> As in Table 6C.1.

<sup>d</sup> Gender: 234 males, and 160 females.

Notes: As in Table 6C.1.

**Table 6C.3**

Two within-subjects factors and one between-subjects factor design ANOVA table (sub-sample: low environmental morale)

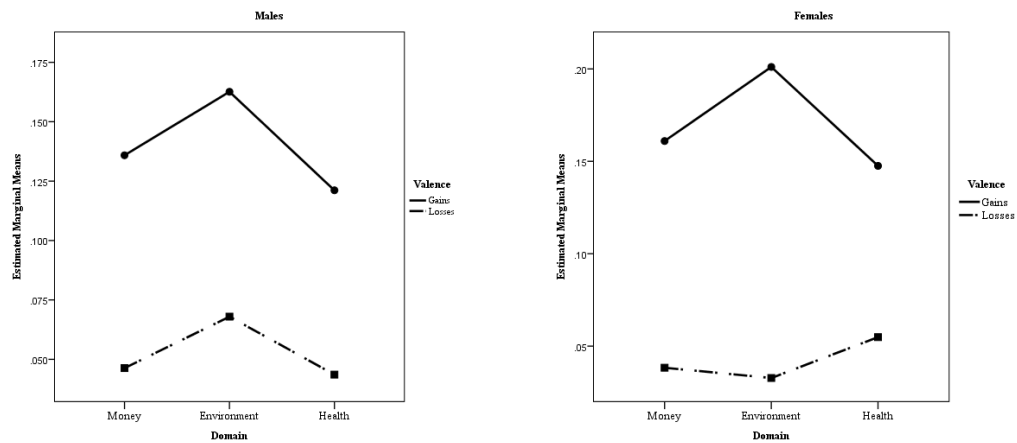
<i>Effect</i>	<i>SS<sup>a</sup></i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>p-value<sup>b</sup></i>	<i>Partial(η<sup>2</sup>)<sup>c</sup></i>
Between-subjects (S):						
Gender <sup>d</sup>	0.043	1	0.043	0.196	0.660	0.004
Error (S/Gender)	10.010	46	0.218			
Within-subjects:						
Valence	1.232	1	1.231	22.263	0.000	0.326
Valence × Gender	0.347	1	0.347	6.284	0.016	0.12
Error (Valence × S/Gender)	2.543	46	0.055			
Domain	0.059	2	0.029	0.398	0.672	0.009
Domain × Gender	0.009	2	0.005	0.064	0.938	0.001
Error (Domain × S/Gender)	6.773	92	0.074			
Valence × Domain	0.005	2	0.028	0.067	0.935	0.001
Valence × Domain × Gender	0.055	2	0.028	0.794	0.455	0.017
Error (Valence × Domain × S/Gender)	3.206	92	0.035			
<i>Mauchly's Test of Sphericity<sup>e</sup></i>						
Valence	$\chi^2(0)=1, p=.$					
Domain	$\chi^2(2)=2.698, p=0.259$					
Valence × Domain	$\chi^2(2)=0.552, p=0.092$					
<i>Levene's Test of Equality of Error Variance<sup>f</sup></i>						
Monetary Gains	$F(1, 46)=1.519, p=0.224$					
Monetary Losses	$F(1, 46)=0.664, p=0.419$					
Environmental Gains	$F(1, 46)=0.883, p=0.366$					
Environmental Losses	$F(1, 46)=12.029, p=0.001$					
Health Gains	$F(1, 46)=0.019, p=0.892$					
Health Losses	$F(1, 46)=4.061, p=0.050$					

<sup>a,b,c,e,f</sup> As in Table 6C.1.

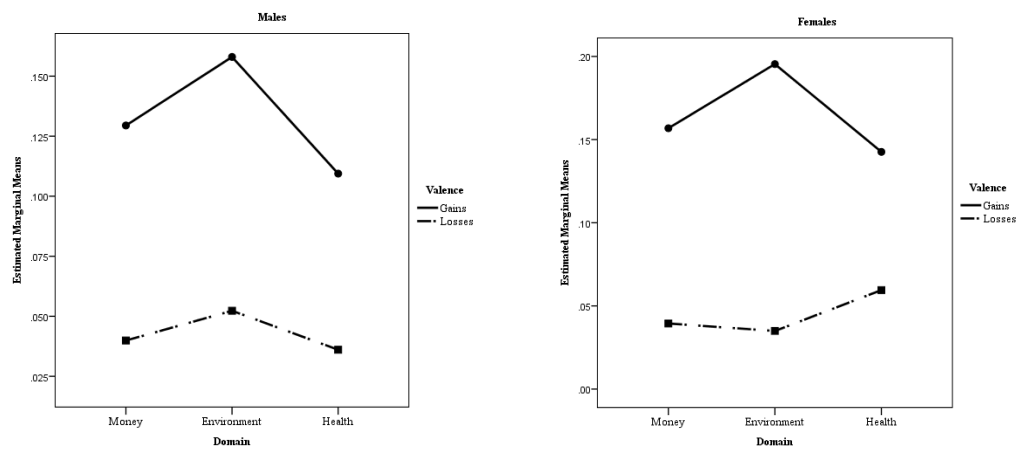
<sup>d</sup> Gender: 37 males, and 11 females.

Notes: As in Table 6C.1.

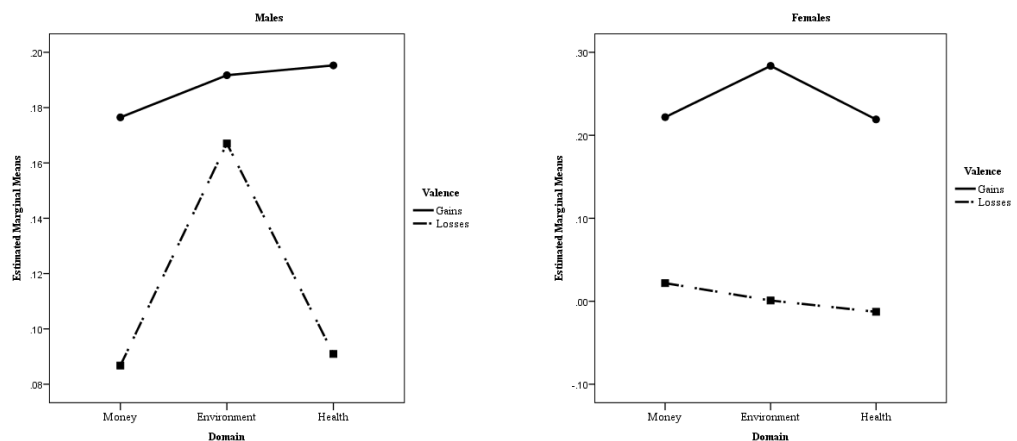
**Figure 6C.1:** Gender differences - Estimated marginal means across valence and domain  
Full model



Sub-sample: Medium/High Environmental Morale



Sub-sample: Low Environmental Morale



Notes: The figure is divided into three groups of graphs. The top of the figure shows estimated marginal means across valence and domain for males and females in the full model. Similar estimations for the sub-sample of respondents with medium/high environmental morale and low environmental morale are reported respectively in the middle and in the bottom of the figure.

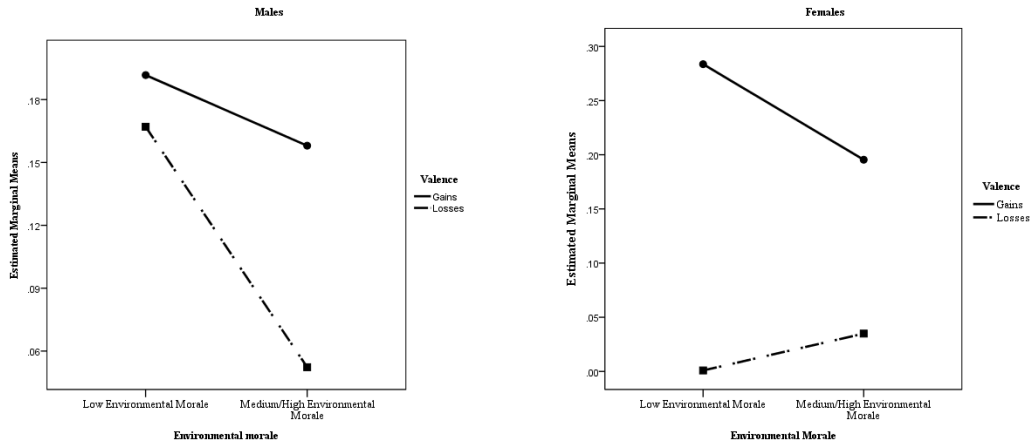
**Table 6C.4**

One within-subjects factor and two between-subjects factors design ANOVA table

<i>Effect</i>	<i>SS<sup>a</sup></i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>p-value<sup>b</sup></i>	<i>Partial(η<sup>2</sup>)<sup>c</sup></i>
Between-subjects (S):						
Gender <sup>d</sup>	0.011	1	0.011	0.153	0.696	0.000
Environmental morale <sup>d</sup>	0.160	1	0.160	2.148	0.144	0.005
Gender × Environmental morale	0.035	1	0.035	0.464	0.496	0.001
Error (S/Gender and Environmental morale)	32.608	438	0.074			
Within-subjects:						
Valence	1.28	1	1.28	31.193	0.000	0.066
Valence × Gender	0.381	1	0.381	9.278	0.002	0.021
Valence × Environmental morale	0.007	1	0.007	0.162	0.688	0.000
Valence × Gender × Environmental morale	0.161	1	0.161	3.92	0.048	0.009
Error (Valence × S/Gender and Environmental morale)	17.978	438	0.041			
<i>Mauchly's Test of Sphericity<sup>e</sup></i>						
Valence	$\chi^2(0)=1, p = .$					
<i>Levene's Test of Equality of Error Variance<sup>f</sup></i>						
Environmental Gains	$F(1, 438)=3.558, p = 0.014$					
Environmental Losses	$F(1, 438)=14.782, p = 0.000$					

<sup>a,b,c,e</sup> As in Table 6C.1.<sup>d</sup> Gender: 271 males, and 171 females. Environmental morale: 394 respondents with medium/high environmental morale, and 48 respondents with low environmental morale.<sup>f</sup> The Levene's Test of Equality of Error Variances tests the null hypothesis that the error variance of the dependent variable is equal across males and females with different levels of environmental morale. A p-value > 0.05 provides support for the null hypothesis.*Notes:* SPSS output. Design: *intercept + gender + environmental morale + gender × environmental morale*. Within-subjects Design: *valence*.

**Figure 6C.2:** Gender differences - Estimated marginal means across valence levels of environmental morale (domain = Environment)





## APPENDIX 6D: THE EFFECT OF YEAR OF DEGREE ON DISCOUNTING

**Table 6D.1**

Two within-subjects factors and one between-subjects factor design ANOVA table (full model)

<i>Effect</i>	<i>SS<sup>a</sup></i>	<i>Df</i>	<i>MS</i>	<i>F</i>	<i>p-value<sup>b</sup></i>	<i>Partial(η<sup>2</sup>)<sup>c</sup></i>
Between-subjects (S):						
YD <sup>d</sup>	0.304	2	0.152	1.487	0.227	0.007
Error (S/YD)	44.933	439	0.102			
Within-subjects:						
Valence	4.471	1	4.471	99.020	0.000	0.184
Valence × YD	0.163	2	0.082	1.809	0.165	0.008
Error (Valence × S/YD)	19.820	439	0.045			
Domain	0.214	2	0.107	2.469	0.085	0.006
Domain × YD	0.057	4	0.014	.331	0.857	0.006
Error (Domain × S/YD)	38.138	878	0.043			
Valence × Domain	0.105	2	0.053	2.043	0.130	0.005
Valence × Domain × YD	0.070	4	0.017	0.675	0.609	0.003
Error (Valence × Domain × S/YD)	22.649	878	0.026			
<i>Mauchly's Test of Sphericity<sup>e</sup></i>						
Valence	$\chi^2(0)=1, p = .$					
Domain	$\chi^2(2)=0.495, p = 0.781$					
Valence × Domain	$\chi^2(2)=0.692, p = 0.708$					
<i>Levene's Test of Equality of Error Variance<sup>f237</sup></i>						
Monetary Gains	$F(1, 439)=0.358, p = 0.699$					
Monetary Losses	$F(1, 439)=0.477, p = 0.621$					
Environmental Gains	$F(1, 439)=1.525, p = 0.219$					
Environmental Losses	$F(1, 439)=4.010, p = 0.019$					
Health Gains	$F(1, 439)=0.238, p = 0.788$					
Health Losses	$F(1, 439)=4.943, p = 0.008$					

<sup>a</sup>Type III sum of squares.

<sup>b</sup>Results are evaluated at the 5% significance level.

<sup>c</sup> Partial eta squared,  $\eta^2$ , is used to assess the effect size of each factor (i.e. the % of variance attributable to each factor).

<sup>d</sup> YD (Year of Degree): 268 first year students, 78 second year students, and 96 third year students.

<sup>e</sup> The Mauchly's Test of Sphericity is testing the null hypothesis of homogeneity of variance. A p-value > 0.05 provides support for the null hypothesis.

<sup>f</sup> The Levene's Test of Equality of Error Variances tests the null hypothesis that the error variance of the dependent variable is equal across first, second and third year students for different outcomes. A p-value > 0.05 provides support for the null hypothesis.

Notes: SPSS output. Design: *intercept* + *YD*. Within-subjects Design: *valence* + *domain* + *valence\*domain*

<sup>237</sup> As in previous note.

**Table 6D.2**

Two within-subjects factors and one between-subjects factor design ANOVA table (sub-sample: medium/high environmental morale)

<i>Effect</i>	<i>SS<sup>a</sup></i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>p-value<sup>b</sup></i>	<i>Partial(η<sup>2</sup>)<sup>c</sup></i>
Between-subjects (S):						
YD <sup>d</sup>	0.218	2	0.109	1.242	0.290	0.006
Error (S/YD)	34.320	391	0.088			
Within-subjects:						
Valence	3.865	1	3.865	89.205	0.000	0.186
Valence × YD	0.148	2	0.074	1.705	0.183	0.009
Error (Valence × S/YD)	16.940	391	0.043			
Domain	0.163	2	0.082	2.037	0.131	0.005
Domain × YD	0.065	4	0.016	0.404	0.806	0.002
Error (Domain × S/YD)	31.327	782	0.040			
Valence × Domain	0.164	2	0.082	3.322	0.037	0.008
Valence × Domain × YD	0.042	4	0.011	.0427	0.789	0.002
Error (Valence × Domain × S/YD)	19.307	782	0.025			
<i>Mauchly's Test of Sphericity<sup>e</sup></i>						
Valence	$\chi^2(0)=1, p=.$					
Domain	$\chi^2(2)=0.514, p=0.773$					
Valence × Domain	$\chi^2(2)=1.511, p=0.470$					
<i>Levene's Test of Equality of Error Variance<sup>f</sup></i>						
Monetary Gains	$F(1, 391)=0.330, p=0.719$					
Monetary Losses	$F(1, 391)=1.652, p=0.193$					
Environmental Gains	$F(1, 391)=1.322, p=0.268$					
Environmental Losses	$F(1, 391)=3.948, p=0.020$					
Health Gains	$F(1, 391)=1.357, p=0.259$					
Health Losses	$F(1, 391)=5.914, p=0.003$					

<sup>a,b,c,e,f</sup> As in Table 6D.1.

<sup>d</sup> YD (Year of Degree): 239 first year students, 70 second year students, and 85 third year students.

Notes: As in Table 6D.1.

**Table 6D.3**

Two within-subjects factors and one between-subjects factor design ANOVA table (sub-sample: low environmental morale)

<i>Effect</i>	<i>SS<sup>a</sup></i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>p-value<sup>b</sup></i>	<i>Partial(η<sup>2</sup>)<sup>c</sup></i>
Between-subjects (S):						
YD <sup>d</sup>	0.808	2	0.404	1.967	0.152	0.080
Error (S/YD)	9.245	45	0.205			
Within-subjects:						
Valence	0.584	1	0.584	9.564	0.003	0.175
Valence × YD	0.142	2	0.071	1.160	0.323	0.049
Error (Valence × S/YD)	2.749	45	0.061			
Domain	0.074	2	0.037	0.493	0.612	0.011
Domain × YD	0.009	4	0.002	0.029	0.998	0.001
Error (Domain × S/YD)	6.774	90	0.075			
Valence × Domain	0.046	2	0.023	0.650	0.524	0.014
Valence × Domain × YD	0.091	4	0.023	0.644	0.633	0.028
Error (Valence × Domain × S/YD)	3.171	90	0.035			
<i>Mauchly's Test of Sphericity<sup>e</sup></i>						
Valence	$\chi^2(0)=1, p = .$					
Domain	$\chi^2(2)=2.616, p = 0.270$					
Valence × Domain	$\chi^2(2)=4.409, p = 0.11$					
<i>Levene's Test of Equality of Error Variance<sup>f</sup></i>						
Monetary Gains	$F(1, 45)=8.5, p = 0.001$					
Monetary Losses	$F(1, 45)=0.447, p = 0.642$					
Environmental Gains	$F(1, 45)=4.555, p = 0.016$					
Environmental Losses	$F(1, 45)=0.587, p = 0.560$					
Health Gains	$F(1, 45)=1.872, p = 0.166$					
Health Losses	$F(1, 45)=6.325, p = 0.004$					

<sup>a,b,c,e,f</sup> As in Table 6D.1.

<sup>d</sup> YD (Year of Degree): 29 first year students, 8 second year students, and 11 third year students.

Notes: As in Table 6D.1.

**Table 6D.4**

One within-subjects factor and two between-subjects factors design ANOVA table

<i>Effect</i>	<i>SS<sup>a</sup></i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>p-value<sup>b</sup></i>	<i>Partial(η<sup>2</sup>)<sup>c</sup></i>
Between-subjects (S):						
YD <sup>d</sup>	0.255	2	0.127	1.715	0.181	0.008
Environmental morale <sup>d</sup>	0.221	1	0.221	2.979	0.085	0.007
YD × Environmental morale	0.164	2	0.082	1.105	0.332	0.005
Error (S/YD and Environmental morale)	32.366	436	0.074			
Within-subjects:						
Valence	0.506	1	0.506	12.124	0.001	0.027
Valence × YD	0.117	2	0.059	1.406	0.246	0.006
Valence × Environmental morale	0.039	1	0.039	0.946	0.331	0.002
Valence × YD × Environmental morale	0.056	2	0.028	0.669	0.513	0.003
Error (Valence × S/YD and Environmental morale)	18.196	436	0.042			
<i>Mauchly's Test of Sphericity<sup>e</sup></i>						
Valence	$\chi^2(0)=1, p=.$					
<i>Levene's Test of Equality of Error Variance<sup>f</sup></i>						
Environmental Gains	$F(1, 436)=2.332, p=0.042$					
Environmental Losses	$F(1, 436)=7.518, p=0.000$					

<sup>a,b,c,e</sup> As in Table 6D.1<sup>d</sup> YD (Year of Degree): 268 first year students, 78 second year students, and 96 third year students. Environmental morale: 394 respondents with medium/high environmental morale, and 48 respondents with low environmental morale.<sup>f</sup> The Levene's Test of Equality of Error Variances tests the null hypothesis that the error variance of the dependent variable is equal across first, second, and third year students with different levels of environmental morale. A p-value > 0.05 provides support for the null hypothesis.Notes: SPSS output. Design: *intercept* + *YD* + *environmental morale* + *YD* × *environmental morale*. Within-subjects Design: *valence*.

## Chapter 7

# CONCLUSIONS

## 7.1 INTRODUCTION

The harmful impact of human activities on environmental conservation and non-renewable resource exhaustion are becoming a matter of great concern with each passing year. Over the last four decades, environmental economics has been mainly focused on developing solutions for market failures. The idea that economic theory can correct market failures is based on the assumption of rational behaviour. Rational choice theory can only guide environmental policy if people make consistent and systematic choices. However, there are circumstances in which individuals' behaviour departs from rational expectations. Since its advent, behavioural economics analyses, catalogues and explains systematic deviations from rational choices by introducing more psychology into economics. Despite the attention that behavioural economics has received in different fields of study (i.e., tax compliance, individual cooperation), environmental and resource economics includes little empirical evidence aimed at analysing behavioural failures into environmental contexts.

This study makes a contribution to this area of research. The analysis makes: (i) a theoretical contribution *via* exploring the concept of environmental morale; (ii) an empirical contribution *via* analysing the linkage between environmental morale and recycling behaviour and intertemporal choices; and (iii) a policy contribution by discussing the relevant policy implications stemming from (i) and (ii).

## 7.2 MAJOR FINDINGS AND IMPLICATIONS

The importance of morale considerations (or social norms) in human life has been widely recognized in different fields of study such as tax and benefit compliance. However, to date there are only a few contributions (mostly theoretical) to the

literature that analyse the link between environmental morale and individuals' behaviour. This motivated the current research. Theoretically the study provides a novel and broader definition of environmental morale, which is discussed in chapter 2 along with its possible link with 'other-regarding' preferences, namely social norms, altruism, and reciprocal preferences. Specifically, environmental morale is viewed in this analysis not only as the act of doing an action for its intrinsic satisfaction, but also as a moral obligation that comes from individuals' concern about the environment.

Based on this definition, the study empirically investigates how environmental morale interplays with individuals' behaviour within two different contexts: recycling participation under different policy schemes (i.e., a voluntary scheme, a facilitating *nudge* policy, and a mandatory scheme), and intertemporal choices among different domains (i.e., monetary, environmental and health outcomes) and valence (i.e., gains and losses). The rationale for separate analysis in each of these contexts is addressed respectively in chapters 3 and 6 of this thesis and is pertinent to what follows. Understanding the interaction between intrinsic and extrinsic motivations as well as studying the factors that affect discounting is crucial for successful policy implementation. On the one hand, intrinsic motivation in the form of environmental morale might render certain policy more effective (i.e., crowding-in) and others less effective (crowding-out). On the other hand, ethical considerations might help at explaining how people form expectations about tangible (i.e., money) and intangible (i.e., environment and health) future outcomes. Original survey investigations were employed to analyse these issues. Results are reported and discussed in detail respectively in chapters 4 and 6 of this thesis.

In general, in both contexts empirical results underline the relevance of environmental morale in determining individuals' behaviour towards the environment. Not surprisingly, results indicate that environmentally-friendly individuals are more willing to contribute to environmental preservation (even when this is costly to them in terms of time and trouble costs) and feel the 'urgency' of doing something for the environment 'now', not eventually, and not when this fits well into a schedule. These findings support the idea that *homo economicus*

represents only a single explanation of how human beings act and what they value. Personal motivations and ‘other-regarding’ preferences seem also to play an important role to modelling ‘real life’ and individuals’ behaviour. Thus, ‘real humans’ – i.e., *homo realitus* – are certainly capable of rational decisions, but might also be ‘predictably irrational’ (see Ariely, 2009) as their actions and reactions are swayed by emotions and constrained by social norms and moral/ethical standards. In other words, they rely on *bounded rationality* (i.e., they have cognitive and information processing capabilities).

Indeed, within the context of recycling, results suggest that individuals react to government policies not only according to their level of environmental morale, but also depending on the nature of the signals. As with other studies in different areas of research (see e.g. Gneezy and Rustichini, 2000b), responses to the follow-up questions and empirical results discussed in chapter 4 support the hypothesis that external regulations can be counterproductive – i.e., crowd-out intrinsic motivation. In particular, the survey revealed that individuals were generally willing to increase their contribution to recycling both with a policy improvement (a facilitating *nudge* policy measure) and the introduction of a fine (a mandatory scheme), with the latter having a stronger disciplining effect on respondents. However, the crowding-out effect of intrinsic motivation was predominant in the mandatory scheme, whereas the crowding-in effect was stronger in the facilitating *nudge* policy measure. Thus, according to results obtained from this analysis, a facilitating *nudge* policy (such as kerbside collection) seems to be more effective than a mandatory scheme in fostering recycling motivation and behaviour.

Similarly, the survey investigation employed to analyse the relationship between environmental morale and individuals’ intertemporal choices provides further evidence of *behavioural failures*. As discussed in chapter 5, a large number of theoretical and empirical studies (see e.g. Sáez and Requena, 2007, Almansa and Martínez-Paz, 2011, and Stern, 2007) have recently advocated the employment of a lower discount rate than that used in the financial market ‘as a grant to future generations’. This is generally justified by ethical considerations regarding intergenerational issues and environmental sustainability. In line with the ongoing

debate, environmentally-friendly respondents were expected to be less likely to exhibit a rate of pure time preferences higher than zero. Indeed, according to the literature, ethical concerns are more likely to activate a deliberative (or cognitive) system, thus leading individuals to normatively disapprove of discounting as this is against social justice towards future generations. However, as discussed in chapter 6, results from this study move in an opposite direction and show that, compared to less environmentally-friendly individuals, those who cared more about the environment were also more impatient. As such, they discounted environmental gains more than losses with a rate of pure time preference (on average) a long way away from zero.

The question is: how can these findings affect thinking about environmental policy? More importantly, how can they inform policy makers? As regards recycling participation, results seem to support a *libertarian paternalism* approach (see Thaler and Sunstein, 2008) – i.e., policies need to be designed to correct individual failures. As noted in chapter 1, libertarian paternalism – *paternalistic* as it claims government legitimacy to stop individuals making ‘wrong’ decisions, and *libertarian* as in principle ‘choice architects’ (i.e., policy makers) cannot impede individuals’ freedom of choice – is a response to systematic behavioural anomalies documented by behavioural economics. *Libertarian paternalism* is implemented by *nudging* individuals towards ‘desirable’ choices. Specifically, the *nudge* perspective diverges from the neoclassical perspective, in so far as the focus is not on the change in economic constraints individuals face, but on finding ways to influence the choice architecture in which individuals operate. Although in recent years a large consensus has been formed around this new form of intervention (see e.g. Shogren and Taylor, 2008), it is also important to acknowledge that some scholars (see Sugden, 2008, 2009) express their reservations about the adoption of such a form of paternalism. Major criticisms against Thaler and Sunstein’s arguments in favour of *nudge* can be summarised as follows. First, there is lack of credibility of the idea that the libertarian component can be realistically consistent with paternalism. Indeed, if individuals make systematic mistakes any interventions that a paternalistic judges to be in the individuals’ well-being can potentially be justified. Secondly, Thaler and Sunstein (2008, pp. 79-84) offer general guidance as to situations in which nudges can be beneficial to individuals – i.e., when there is lack of self-control, when decisions



are difficult and infrequent, when feedback to individuals is rare, when nudgers have more expertise than individuals, and finally, when tastes and needs of individuals can be easily identified. However, in their seminal book the definition of most of these criteria remains generally vague. Lack of precision is also present in most of the arguments supporting the statement that individuals *want* to be nudged, against the more realistic statement that they *might* want to be nudged (see Sugden, 2009). Finally, in contrast to neoclassical economics and in order to reduce complexity, *nudge* supports the idea that the number of choices that individuals face need to be restricted as this reduces the chances of losing the ‘optimal’ choice. However, a restriction on the choice ‘overload’ might benefit some groups more than others, which raises the problem of whose group preferences need to be assigned greater relevance. Thus, “...if it is possible to design policies to change behaviour, it is also important to be aware of all of the implications of policies that are designed to nudge” (see e.g. Weyman et al., 2013, p. 163).

This said, drawing on results obtained from this analysis, the answer to the questions mentioned above depends on whom you ask and on what governments really need to achieve. A libertarian paternalist would favour a facilitating *nudge* policy measure over mandatory schemes as “better governance requires less in the way of government coercion and constraint, and more in the way of freedom to choose” (see Thaler and Sunstein, 2008, p. 15). Moreover, if government aims at attaining a positive long-run effect, a facilitating *nudge* intervention might be more desirable as it seems to boost individuals’ intrinsic motivation towards recycling (see Rege, 2004). Thus, building upon the insights of Cognitive Evaluation Theory (CET), in this context external regulation will be more likely to be internalised into an autonomous regulation. By contrast, anti-libertarian paternalists would probably express reservations about a facilitating *nudge* policy as there is always a feasible alternative to paternalism, and this “is what it has always been – the market” (see Sugden, 2008, p. 247). Indeed, based upon the above evidence and with the objective of short-run effectiveness, mandatory schemes seem to be more attractive (i.e., they can generate stronger disciplining effects).

Moving to discounting, individuals' preferences revealed the existence of a *paradox of hyperopia*. Thus, compared to less environmentally-friendly respondents, eco-friendly people not only discounted environmental gains more than losses, but they were also less willing to postpone losses to future generations. In its essentials, the argument can be explained as follows. Traditionally, the discounting literature has associated impatience with the tendency of acting in self-interest – i.e., people prefer consumption now rather than later and the reverse for costs. However, results from this analysis suggest that this tendency is more likely to be related to selflessness. As such, the benefits of taking actions on the environment 'now' can also spillover to the (near and far distant) future, whereas the lower disposition to postpone costs to future generations result in a less discriminatory practice towards future generations. The core premise is that the 'urgency' of doing something for the environment 'now' among environmentally-friendly individuals translates here into 'benevolence of the present' rather than the 'tyranny of the present' (as suggested by Koundouri, 2009). With this in mind, empirical findings from this analysis seem to support again a more paternalistic role of the government. Government intervention is here advisable not only to sensitise individuals towards more eco-friendly behaviours (e.g. by raising individuals' awareness about environmental damages through national and local information campaigns), but also to enhance environmental sustainability in the long-run.

### **7.3 LIMITATIONS OF THE STUDY AND FUTURE RESEARCH**

It is also important to acknowledge that both surveys are based on students' responses and hypothetical scenarios. As discussed in chapter 4, a growing experimental literature relies on students' responses – i.e., there is no reason, in fact, to think that undergraduate students have a different cognitive process from the adult non-student population (see Alm and Jacobson, 2007). However, there is now an increasing concern over the external validity of studies published in world's top journals that claim to generalise to 'humans' or 'people' results obtained entirely by Western, Educated, Industrialised, Rich and Democratic (WEIRD) undergraduates (see Henrich et al., 2010). Major criticisms over the representativeness of WEIRD subjects concerns how: these people measure up to the relevant reference

populations, people from modern industrialised societies compare with small-scale societies (such as South Africa and New Guinea), people from Western societies compare with people from non-Western industrialised societies, and university students compare with the adult non-student population. Although it is important to recognize the relevance of these criticisms and to acknowledge that these WEIRD people may not reflect the full breadth of human diversity<sup>238</sup>, the peculiarity of the frameworks employed in this study offer insight. Ideally, in order to control for such diversities research programs should promote large-scale experiments extended to a broader sample of individuals, international research as well as collection of data over the full life-cycle of individuals using a wide-variety of experimental techniques. But the world is not ideal. As a future task it might be of interest to extend in further research the surveys to a broader sample of respondents, or to analyse these aspects in a field experiment. Confining the interpretation of results to the population from which individuals were sampled will help reducing problems of over-generalisation of findings.

Regarding the hypothetical bias of stated preferences methods, it might be argued that this problem seems not to play a major role here. The purposes of both empirical analyses were neither to assess which was the best policy to adopt in order to increase individuals' contribution to recycling among those mentioned in the hypothetical settings, nor to provide a specific measure of the discount rate to use in cost-benefit analysis. The surveys employed here were used to shed light on how individuals react (in terms of intrinsic motivation) to different policy schemes (i.e., signals), and to test whether or not people discount all goods in the same way.

However, if in the case of recycling participation it might be argued that hypothetical scenarios served to reduce 'socially acceptable' responses bias (see Orviska and Hudson, 2003), this was not the case for intertemporal choices. Further research is needed in this context to control for potential confounding factors (e.g.,

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<sup>238</sup> This might explain for example why there was not very much variation in many of the socio-demographic/economic indicators used in the survey described and analysed in chapters 3 and 4 (e.g., age, financial satisfaction, occupational and marital status), and why some other relevant variables (i.e., education) were not included into the analysis.

changing the order of the questions, and using less abstract scenarios) which might affect the robustness of the results.

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